AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

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Extracts from Chordal's Letters.

Mr. Editor:

* * * * The business boom has brought to our ears the old charge of stealing men.

As near as I can remember I have heard of no cases, during the last few years, of emissaries slipping around and seducing men away from one shop to work in another at better pay. An owner has been thankful if he could keep his front door open and the line shaft turning around, and the men have been thankful for a job at any pay. The dull times lasted so long that tools were allowed to deteriorate and run down generally, systems flagged, capital was withdrawn, and manufacturing facilities were, in many cases, seriously crippled.

During these times good workmen in many cases became disgusted with a trade which paid such terribly low wages. They quit the business and went into other things, sometimes more profitable, sometimes less, but they at least succeeded in changing the general current of their lives. Some shops had such a poor lot of men left in them that keen-witted boys would not go among them to learn the trade. The less cultivated boys could not get into the shops, and no boy with wit or no wit could learn much from the lot of men which was left. Such circumstances were exceptional, of course, but there was a tendency that way all over. Many good men fell out of the ranks, and few good boys went into the shops.

Now we find that work is plenty in many sections, and sharp workmen hard to get. There has always been some attention paid to keeping good men. Many owners in the dullest times followed the plan of always letting the poorest workmen go, and even replacing them with better ones. Other shops, on the contrary, kept the poorest men because they were cheaper.

* * * * Now we hear some poor, over-crowded owner, with time contracts on hand, with a shop run down at the heel, and with all the men he can get, saying "So and so steals my men away from me. He's a low down, contemptible, dirty cur," etc., etc.

* * * * Now, honestly, Mr. Editor, do you think Mr. so and so is a cur? How does he steal men? By offering them more pay. Auction is theft according to the morals of some. Now I, for one, like to see this stealing going on. It's awfully inconvenient sometimes, but it's a mutual privilege, and out of the rivalry the poor machinist manages to get his full value. A machinist is entitled to all the favorable fluctuation in the labor market, and when the bidding is spirited all may laugh, for times are good.

* * * * I have had men stolen from me, and have called the stealer a thief. I have stolen men from other folks and have been called a thief. I have been stolen myself, and always had the most respect for the biggest thief. The way to get men is to pay their value, the way to hold them is to pay their value, and the man gets and holds his place by making himself valuable.

There are employers who look upon mechanics as a class to be bargained with like business men, who consider a mechanic as having the business ability and sharpness to look out for his own interest. There are other employers who feel and know that working men are not business men, and can not do well by themselves, that they deal in force rather than in business power, and that they can be imposed on with little effort. They would blush to take advantage of these circumstances, as they would if tempted to bruise the weak. This latter class are not exceptional at all. They are about equal with the first class and they set the wages of the world with a justice which is certainly admirable under the circumstances.

* * * * If a man is filling a situation he brings down the wrath of his employer if he listens to better offers. I claim that when a man sells his services for the time being to another man, it is his duty to listen carefully to every thing which indicates to him his present or prospective value. A man ought to be ashamed of himself who does not say every day: "I expect to be more valuable some day;" and the employer ought to be ashamed of himself who will dicker with a man for his present services and then assume that the man should turn a deaf ear to every offer. * * * Warwick has a superintendent at eighteen hundred a year. Both were satisfied. The superintendent Byron didn't know his real value and Warwick didn't care. But Mr. Timmerman comes along. He don't care anything for Byron but he wants a good superintendent; he wants Byron, and knows his value. He don't propose to pay any more than he can help, but he does propose to pay somewhere between eighteen hundred dollars and the real value of the man, so he goes to Warwick's place and offers Byron twenty five hundred dollars a year or a third interest in his place. Byron is not on a contract. If he was he would not violate it, and if he was Timmerman would not be a party to the violation. Byron goes to Warwick and states the case. Warwick talks ugly right away, and accuses Timmerman of dishonorable conduct in coming into his mill on such an errand, and accuses Byron of dishonorable conduct in not kicking him right out. The only questionable feature I can see in the play is Warwick's conduct.

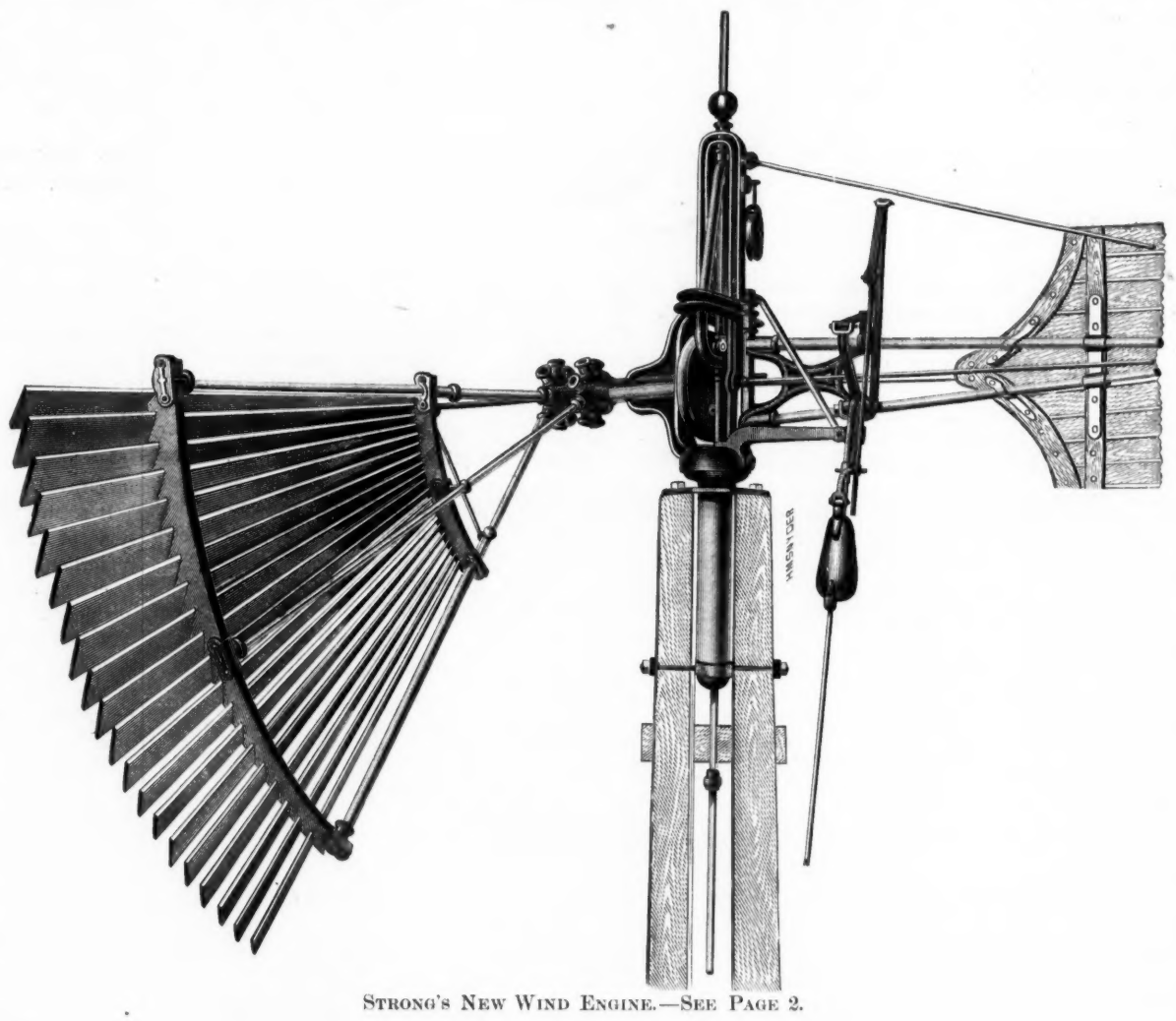
* * * * I claim that when one man goes to work for another for the time being, he reserves the right to constantly exert himself to do better, and also the right to invite better offers right on the premises. The idea of presuming that paying a man for present services gives the right to blindfold him and stop up his ears for ever!

* * * * Into this question of course comes the policy of leaving a permanent place for a temporary place at a higher figure. It is supposed that common sense will cover such cases, and any man will understand that once in a while somebody will offer him more than his value, on account of pressing necessities of service. Wise men never bite at such things. A little judgment will tell if a figure is too high to be permanent.

* * * * The twisting block-man has been around. If differential pulley blocks have a profound admirer in this world, that man is myself. I have had the ill luck to work in one or two shops that didn't have them, and when I came in contact with the ugly clanking things I began to appreciate their usefulness, and the more I have seen of them, the more I have liked them. There are annoying features connected with them, but they are over-balanced a thousand times by their good qualities. Some of the first blocks made were poor things every way. After a while the makers learned how to make them, and we had good blocks. After a while a chain would give out, and we would get a new one from some chain factory. In about three days the new chain would stretch and fail to mesh in the sprocket wheels. Then we would send to the maker, and get the right kind of a chain. We would put that on and find it slipped. Then we would send and get new top rig, and if it fit the new chain we would be happy once more. If it would not fit we would throw the whole thing aside and condemn all differential blocks, and say we never wanted to see another pair. In a week we would order a new one and in course of time we would go through the same old business again. Then we would buy a set of blocks of English make, and when the music began on them we would find no new chain to fit.

These blocks should be very carefully made, especially the wheels and chain. Every one who has ever had anything to do with chain-driving devices, I pity all such men, knowing that it is one of those pieces of work which looks as though it would not be accurate. One soon finds however that if the pitch of the sprockets varies a sixty-fourth of an inch from the length of a chain link, it will vary about a mile when you get half way round the wheel. There is only one way these things will work nice, and that is when the pitch of sprockets and links is precisely the same.

These differential pulley blocks bring in exactly the same questions. The makers got the thing reduced to a practical science at last, just the same as the unlucky man working with chain belts. Now more trouble comes in. After a chain with a uniform and measurable length of link has been discovered; after a sprocket wheel has been designed to fit this marvelous chain; after everything is put together and found to work splendidly; then and not till then this rare chain stretches a trifle, and knocks all the fine experimenting into a cocked hat. In chain blocks, as in



STRONG'S NEW WIND ENGINE.—SEE PAGE 2.

chain gearing generally, two things must be secured if possible. First an accurate sprocket wheel, and second a chain of uniform link to fit the sprocket wheel and incapable of stretching any to hurt.

The matter of pitch is so important that if one sprocket wheel works nicely, a casting made from that wheel, as a pattern, will not work nicely. The little shrinkage there is in a six inch wheel will effect the thing.

With all this trouble with weak chains which break, and weak chains which stretch, and variagated chains with no two links alike, and wheels which wont fit any place in any chain—with all these things in full view—differential chain blocks are a good institution. I would not keep house in a machine shop without such blocks if I had to pawn the "dearest" chain-feed lathe in the shop to get them.

* * * * The new chain blocks which the makers are now shaking before us are not differentials. They are overhead winding machines operated by a worm revolved by a hand chain. Some of them wind their hoisting chain up on a reel, while others simply pass the hoisting chain over a reel after the order of a belt, holding it by sprockets. The hand chains are light and do not change length. These machines are terribly big and heavy and must have virtues to make them comparable to the convenient differentials. I have my eye on two of the new rigs, and may report some day.

* * * * Very respectfully,

CHORDAL.

Wind Engine for Railroad Water Stations.

The engraving on first page represents an 18 feet wind engine designed for pumping water for locomotive tanks, which are ordinarily a constant source of expense to a rail road company. Where a steam pump is used to do the pumping, the services of an engineer are required, with a consumption of ten to twenty tons of coal per month. Both of these heavy items of expense would be avoided by the use of an efficient wind engine, thereby making a saving of from fifteen hundred to twenty-five hundred dollars per year. On a line of five hundred miles this economy would ordinarily amount to about $50,000 per annum. All that is required to make the system of pumping by wind power equally reliable with steam is enough surplus tankage to store water for thirty-six hours' use, as it has been found that there is very seldom a calm that continues twenty-four hours. The mill here represented has a capacity of about five thousand gallons per hour, on a lift of one hundred feet, and (its projector claims) is constructed to do the greatest amount of work with the least amount of wind, and with the least possible amount of wear, or liability to derangement.

The turn-table is a simple pivot working on the end of a supporting column. The entire weight of the mill rests on the bottom of the bed piece, which is a cylindrical piece with flanges at its top. These flanges support it on the four posts, or timbers, which form the mast. The mast has, at its top, a brass collar, which takes the lateral friction of the turn-table. This is all capped over, with a large recess for oil under the cap, and makes a very simple and easy-working turn-table, and one that never gets out of order. The governor is arranged in such a manner that, as the wind increases above a certain pressure, the wheel swings around, throwing its edge to the wind. The wheel is controlled by a compensating lever, on which the governor weight travels, so that, as the wind increases, and the wheel is thrown off the center, it is not, under ordinary circumstances, allowed to be thrown suddenly or entirely "out of wind," but is held to the wind and caused to maintain a steady and regular motion regardless of the velocity of wind. In a very severe gale, it is allowed to come entirely "out of wind;" as soon as the wind subsides it comes "into wind" again, and continues its work. The wheel is constructed with double braced tubular iron arms—eight main and eight bracing—with braces to the shaft, which extends out through the center. There are eight sections of the sails, which are held in hard wood rims, at the angles of thirty on the outer rim, and thirty-five on the inner rim, giving the sails almost a true screw, and as the rims are held in malleable iron clamps, well bolted up, there is no shrinkage in the wheel, which is a source of great annoyance in wheels constructed entirely of wood. The wheel has a sleeve which runs on the pipe box, or bearing, and takes the vibration from the shaft and greatly strengthens it. The connecting rod works above the center in a staple connection, which allows it to swivel so that it cannot be out of line, or bind, and admits of having the turn-table as it is. The connecting rod is a forged rod with gibs and brasses, as well fitted up as those used in any engine, the bearings being all constructed with a view to the greatest durability.

This style of mill or engine has stood the test of four years' practical use, and has given universal satisfaction.

Burnham's Turbine Water Wheel.

Among the turbine water wheels that have gained many high encomiums from users is the one illustrated upon this page, and the one opposite. It is the production of N. F. Burnham, York, Penna., who has obtained several patents upon it, the first dating Feb., 1859. The "1874" turbine is not only well constructed but the adjustments work readily and efficiently. High per centage of power has not been permitted to crowd out other desirable qualities, though economy of water is one of the distinguishing features of this wheel. Durability and simplicity have been carefully looked after in the arrangement of parts. Nothing is concealed under cover, except the wheel proper and the case, each of which is a single casting. There is no cog-gearing to operate the gate, nor can sand be forced between the shaft and the wood followers.

The engravings on this page were made from photographs taken from full size

Fig. 1.

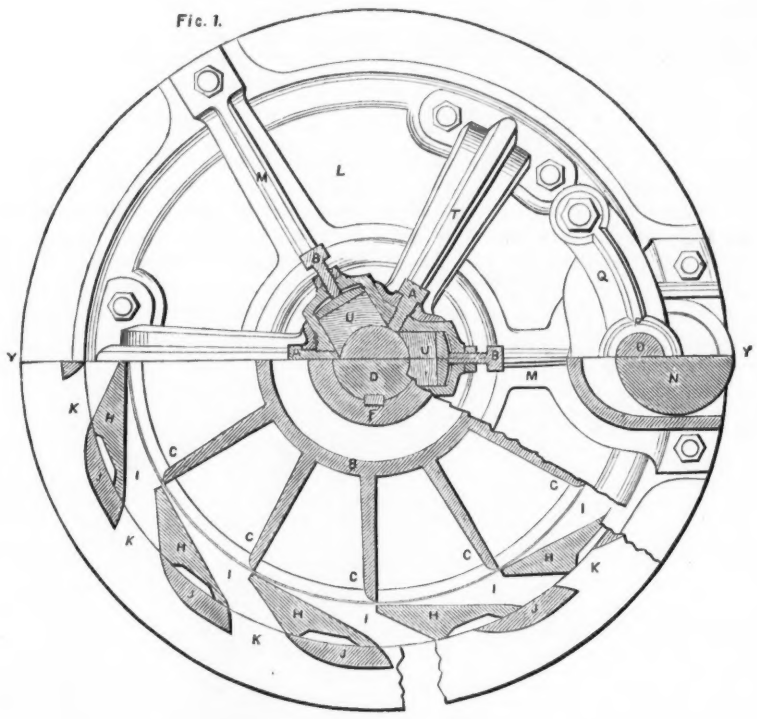
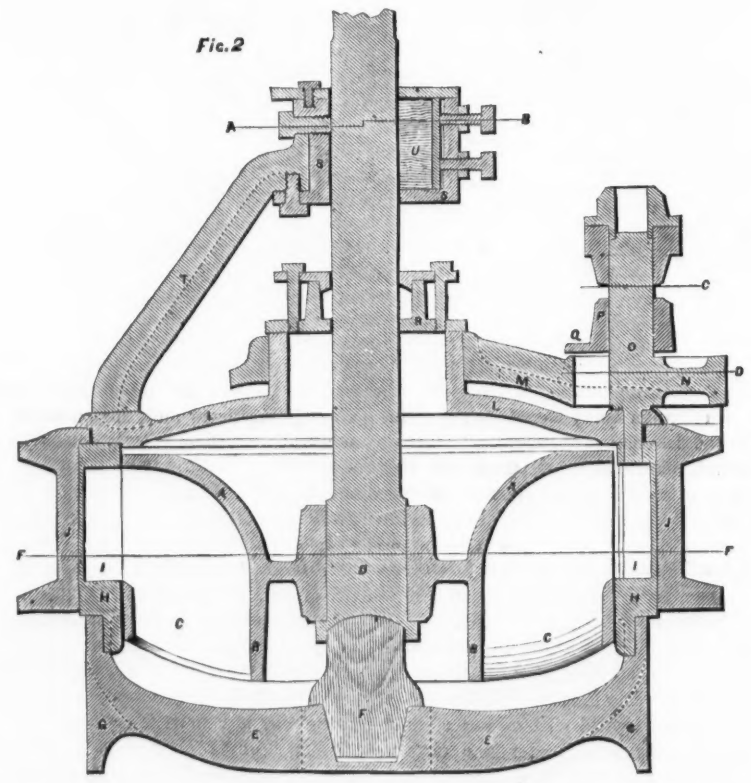


Fig. 2



For further particulars, either regarding the manufacture or purchase of mills, address Geo. S. Strong, the designer, care Kelly & Ludwig, Filbert St, below Eighth, Philadelphia.

Business along the Hudson river has been materially injured by the failure of the ice crop. Kingston, it is estimated, will lose $100,000 by the non-employment of men who regularly depend upon the ice-harvesting as means of support during the winter.

For further particulars, either regarding the manufacture or purchase of mills, address Geo. S. Strong, the designer, care Kelly & Ludwig, Filbert St, below Eighth, Philadelphia.

Fig. 1 is a plan view, also horizontal sections on the lines A B, C D, and F F, of Fig. 2; and Fig. 2, a vertical section of the entire wheel on the line Y Y, of Fig. 1. Similar letters of reference indicate corresponding parts in the two figures.

A, Upper concave part of the hub; B, lower part of the hub; C, lower part of the buckets which are curved upward to the band on the periphery of wheel.

D, Shaft to transmit the power of the water wheel.

E, Cross or bridgetree; F, wood-step fitted into the center of the bridgetree; G, legs cast on the bridgetree.

H, Case, having on it a downward projecting cylinder to which the bridgetree is riveted; I, water ways in the case through which the water is applied to the buckets of the wheel.

J, Rotary gate; K, slots in the gate which correspond with the outside of the water ways in the case.

L, Cover which overlaps the top of gate, and is fitted to the top and the inside of the case, forming a water-tight joint; the center of it is raised, forming a flange for packing-box to rest on, and a bearing for the center of gate-arms and cam-yoke.

M, Gate-arms and eccentric cam-yoke bolted to top of rotary gate.

N, Eccentric wheel; O, eccentric wheel shaft; P, upper bearing for eccentric wheel shaft; Q, cap over eccentric wheel and cam-yoke to prevent gravel or sand from getting in the cam-yoke.

R, Packing-box, which prevents leakage around the wheel shaft.

S, Upper bearing-box, for water wheel shaft.

T, Arms or braces, bolted to bearing-box, S, cover L, and case H.

U, Upper wood bearing blocks for water wheel shaft.

The Mechanical Engineers' Meeting.—Opening Remarks of Mr. A. L. Holley.

After being called to the chair and acknowledging the compliment, Mr. Holley said:—

Gentlemen: Before entering upon the details of organization, we should briefly consider the magnitude and the character of the work we are assembled to undertake; and what I shall say will, perhaps, only formulate and emphasize your own views, as you have thought in advance of this meeting and of its objects.

It seems very remarkable that an Institution of Mechanical Engineering—which underlies all engineering—has not long ago been organized in this country of mechanical engineers. Probably, however, the work will be perfected sooner than if it had been begun earlier, because the material for active membership is now more abundant, and the importance and the methods of successful organization are better known.

We define engineering as the science and the art of utilizing the forces and materials of nature; and we observe that this utilization is accomplished in all or nearly all cases, either directly by machines, or by processes working through machines. I confess that in thinking over the range of mechanical engineering, with reference to our proposed society, I was astonished at its magnitude; I had never realized it before. In that branch of the profession distinctively called civil-engineering, and pertaining to fixed works, how largely mechanical engineering underlies both the structure and its uses. Take the canal; it is built by the steam-dredging machine, the machine-drill, the steam pump, the steam derrick, the temporary railway with its locomotives and cars. The completed canal is operated by the boat which is equally machine-built, and usually steam-propelled. The masonry fort and the masonry lighthouse are essentially military engineering works, but, however much science their planning may involve, their construction is mechanical engineering, by means of the machine-drill, the steam-derrick and steam-transportation.

In bridge-building, the expert tells us that the strain-sheet is not now the difficult matter, and that success chiefly lies—1st, in good methods of joining the parts with reference to strain and expansion, and 2d, in the adaptation of special tools and facilities for shaping and preparing the work *cheaply*, and without injuring it. This is all mechanical engineering.

I would not underrate—I cannot too highly magnify the wide and profound scientific knowledge employed in locating and plan-

ning these vast works of civil engineering—the canal, the harbor, the railway, the tunnel, the pier, the breakwater—I only emphasize the fact that our own profession of mechanics and dynamics underlies their construction and utilization—it is the intermediate power between nature on the one hand, and the artificial structure and the artificial work done on the other hand.

Passing now to that immense department of engineering—mining and metallurgy; it is almost astonishing to find how completely mechanical means and processes produce its results. Geological exploration of the most highly scientific character is essential, but the hydraulic engine, the machine-drill, the steam-pump, the steam-hoist and steam-transportation perform the work.

In metallurgy, a few characteristic examples show the universal imprint of our profession. The analyses of ores, fluxes and slags are indeed indispensable, but it is the elaborate machinery of steam-blowing, steam-hoisting and transportation, and the vast mechanism of heating apparatus, that produce pig-iron. The furnace, of whatever kind, the hot blast stove either of pipes or of bricks, the gas-producer, the regenerator—in short, fire-brick construction at large is an important department of mechanical engineering. The Bessemer process is the grandest exhibition of practical chemistry to be seen in the world, but, as in invention, it is essentially mechanical, and the means of carrying it out involve elaborate and ponderous mechanism at every step—the thousand horse blowing engine, the hydraulic lifting and moving apparatus, the interchangeable parts.

The rolling mill is throughout a series of machines, and much of their work is of the most difficult character; it has been improved by the highest mechanical ingenuity and experience, in many countries, and is still but on the threshold of its possible development. It involves the adaptation of steam engines and boilers under peculiar environment; of roll trains, which are by themselves a vast department of engineering; of power-handling, finishing and transportation, and of the utilization of fuel under varying circumstances and on a gigantic scale.

We need not dwell on the similar relations of mechanical engineering to the foundry, to the forge, and to such immense specialties in iron and steel, as wire, horse shoes, bolts and nuts, springs, agricultural tools, cutlery and hardware at large. What thousands of special tools and machines picture themselves in our minds as we contemplate such manufactures as these?

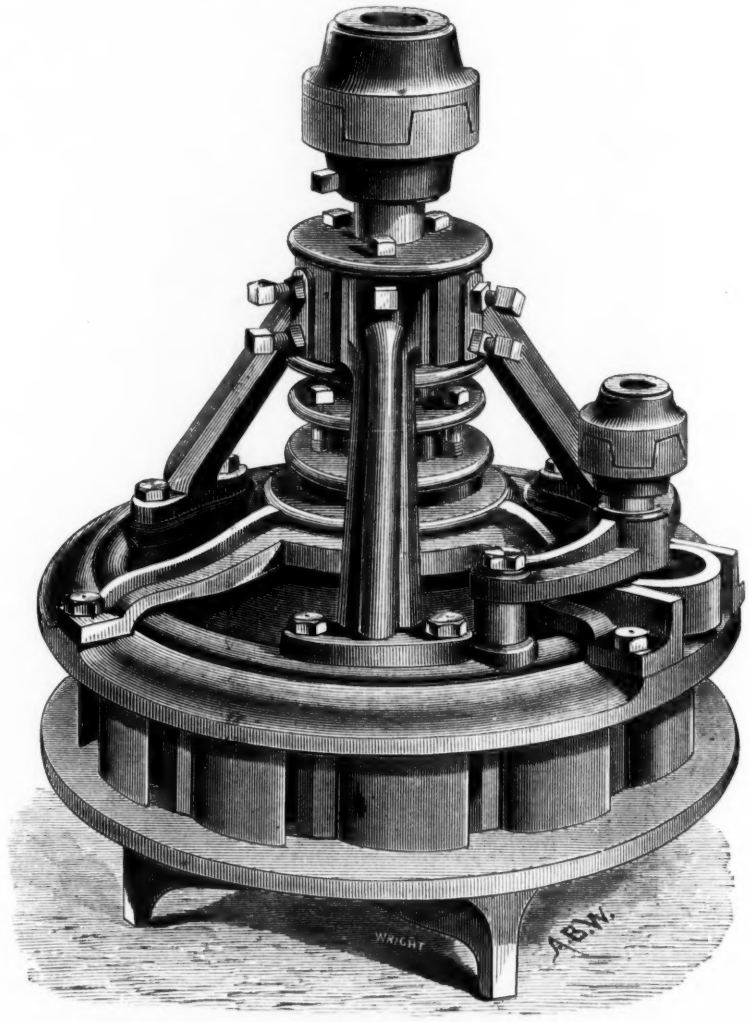
The railway in structure and working is all mechanics and dynamics, however great may be the civil engineering ability displayed in its location and in the designing of its fixed works. Railway master mechanics form perhaps the largest defined class of mechanical engineers, and the chief engineers of railways, in their chief work of permanent way and bridge construction and maintenance, deal chiefly with our department of the profession.

The locomotive builder is called to practice mechanical engineering of the most refined and comprehensive type—the economical generation and use of steam in an almost flying vehicle of minimum weight and maximum power. And the number of his works is measured by tens of thousands. Does not the car builder also deal with machines on the most comprehensive scale—the innumerable wood-working tools and his special appliances for iron work? And speaking of wood-working tools, what vast mechanical ingenuity has been brought into service, and what vast interests are represented in the manufacture of wood in all constructive and ornamental forms, especially in the immense department of furniture.

In those leading departments of industry, which at first thought, the public would deem quite outside of mechanical engineeering, how completely is this art incorporated with their every detail. The manufacture of textile fabrics is a conspicuous example. However indespensable chemical guidance may be, the whole complex system, including the application of chemistry, is mechanical. The same is true of those vast departments of industrial art, the glass manufacture and more conspicuously the manufacture of paper. And is it not equally true in the case of gas-making and electric lighting, of pottery and brick making and of chemical manufactures at large?

What shall we say of architecture? There are the strictly aesthetical and mathematical elements, but the construction—quarrying and shaping, foundry and forge work, excavating and hoisting, are mechanical. Should the architect and the civil engineer say that the mere moulding and assembling of members is not worthy of a professional name and *status;* the mechanical engineer may reply that the mere calculation of strains from known formulæ, and the mere grouping of conventional forms, is no more worthy. The genius that reaches the harmony of perfect construction and perfect beauty (which are interchangeable terms), in Nature's inert materials, may not be loftier than that which as perfectly utilizes and governs her wild and capricious forces.

Modern agriculture is but a world-wide arena for the operation of machines, and these machines, and the machines that produce them, draw upon many departments of mechanical engineering.



BURNHAM'S "1874" STANDARD TURBINE WATER WHEEL.

National defenses, other than old style forts, are among the most conspicuous types of machines; for the modern war-ship, the modern gun and the modern small arm, are nothing but machines of the highest classes. The almost incredible endurance and accuracy of modern ordnance have been achieved, as their grandest work, by mechanical engineers who were most successful in other departments of their art. Shipbuilding, even more than bridge-building, is conspicuously within the range of our profession.

But if the works and industries we have enumerated are the results of our mechanical and dynamic science and art, what shall we say of the steam boiler and engine—of the adaptation they involve, of materials to the economical utilization of force—of machines to the economical production of complex enginery? This greatest department of mechanical, and purely mechanical science, is alone a sufficient basis for the establishment of such an institution as that we have assembled to organize.

In thus briefly referring to the leading types of work in our profession of mechanical engineering, and in enumerating many, but by no means all of the great industrial and structural arts in which the aid of our profession is conspicuous, if not vital, I suppose that I have only formulated your own thoughts; and I imagine also that your review of the scope of our profession was as surprising to you as it was to myself.

We should also briefly consider the advantages and character of our proposed organization:

1st. The most obvious advantage is the collection and diffusion of definite and much-needed information, by means of papers and discussions. The transactions of such societies are now about the only records of our rapidly changing applications of science. In my own department, for instance, I am often asked to name a book on modern iron and steel manufacture, but I know of no satisfactory book. The monographs in the various transactions and technical magazines, are the current literature of industrial art.

2d. A less obvious, but, it seems to me, a more important advantage of organization, is the general personal acquaintance thus promoted, and by no other means promoted, among engineers and the business men associated with them. It is not only a reasonable supposition, but it is a matter of history, that men in the same business, thrown together in technical and social meetings, in excursions and among engineering works, gradually, and often quickly, exchange friendship for jealousy, and helpfulness for rivalry. The grandest work of the British Iron and Steel Institute has been to throw open the works and processes not only of England, but of France, Belgium and Germany, to the observation of all who are interested. It is being found out that fifty men can impart more information to one man than the one can impart to the fifty; and the one is only too glad to show his hand that he may see a much larger number. This free exhibition and information is not without bounds, nor should it be; but the old conservatism has passed away.

3d. The habit of writing and discussing technical papers is of very great importance. It engenders habits of thought at once rapid and accurate. Any man can work better who can formulate the merits and defects of work.

The kind of organization, especially the criterion of membership, is a most important consideration. In the American Institute of Mining Engineers, and in the Iron and Steel Institute of Great Britain, any one is qualified who is *engaged* in mining and metallurgy. The advantages of the association of business men with engineers in these societies are notorious; these advantages are not only large memberships, and hence large incomes to devote to publications and illustrations, but they lie chiefly in the direct business results of bringing professional knowledge, capital, and business talent together under the most favorable circumstances.

In most of the civil engineering societies, the aim is not only to promote knowledge by means of papers and discussions, but to establish such a high professional standard of eligibility that membership shall be recognized as an indorsement.

Now it seems to me that all these ends can be attained in one society by simply calling professional men *members*, and fixing a high standard of qualification; and by an equal discrimination among applicants, making those *associates* who are fitted by scientific or commercial ability and relations to co-operate with engineers. The professional standard is thus maintained, while the other enumerated advantages are gained. I can see no objection to giving an associate all the privileges of the society except the name of member.

Juniors in professional experience should, as is usual, be provided for by that classification.

Those who have had a large experience in the management of such organizations will, I think, agree with me that the Council of the Society should pass upon the qualifications of candidates, who should then be voted for by the sealed letter ballots of the members and associates.

As to officers, I must detain you with a word. The first officers should be men of distinction in the profession, to give the Society character at home and abroad—and at once. They must also be men who will devote time and money, at first, to the building up of the Society. I am sure that the start of 500 or 1,000 members would be lost if the officers were indifferent—if they had not positive enthusiasm in promoting good papers, good discussions, good meetings, and an interested and working membership. And a good *Secretary* is the concentration of good management.

Meetings should not be too infrequent. The Society cannot soon have a local habitation. The Mining Engineers and the Iron and Steel Institute have none; but they have three meetings a year in different parts of the country, which give distant members home facilities from time to time, and keep up the Society interest. Frequent local meetings are necessarily small and often spiritless; members are not stimulated to write or to discuss.

Finally, the rapid and healthy growth of the Society will largely depend on the character of the first few years' papers. With men of work and of note for early officers, and a goodly number of really important and well written papers at the start, the success of the Society of Mechanical Engineers is assured.

The successful voyage of the Strathleven from Australia, with meat preserved in the refrigerating chamber, by the Bell-Coleman cold air machine, was celebrated last Friday by a luncheon, when some of the meat was served. The first shipment was made at Sydney on the 19th of November, and the vessel left Melbourne on the 6th of December. The highest temperature of the sea during the voyage was 83°, while the maximum in the chamber was 26° Fahr. The meat arrived in London frozen hard, and in perfectly good condition.—*Ironmonger, Feb.* 14.

Superintendent H. S. Smith, of the Joilet, Ill., steel works, has received orders from the company to make immediate preparations for operating the immense blast furnaces and merchant steel mill (formerly the iron rail mill) of the company in that city. They have lain idle since 1873.

The Successful Manufacture of Pressed Fuel at Port Richmond, Philadelphia, Pa.

A PAPER READ BEFORE THE AMERICAN INSTITUTE OF MINING ENGINEERS.

BY E. F. LOISEAU.

In a paper on the Manufacture of Artificial Fuel, read at the Philadephia meeting of February, 1878, I enumerated the difficulties which I had to overcome before succeeding in the mixing of coal dust and clay, the compressing of the same mixture, and the waterproofing of the lumps. The drying of the lumps, after leaving the press, was the remaining difficulty, and it was expected that a plan, devised by Dr. C. M. Cresson, of Philadelphia, would enable us to dry the fuel as rapidly as it was moulded, and that a continuous production could in that way be obtained.

The company was reorganized; the works were purchased by the new company at an assignee's sale, and the oven was modified, according to Dr. Cresson's plan.

Anticipating a possible failure, I had prepared a plan by which I expected to be able to demonstrate that anthracite coal dust, mixed with pitch, could be manufactured with our present machinery, slightly modified, so that, after all, if we were compelled to give up the attempt to make fuel for domestic use, there was a possibility of succeeding in the manufacture of a good steam fuel.

The plan suggested by Dr. Cresson, for drying the pressed lumps of coal dust cemented with clay, did not work as well as we expected. It enabled us to dry more fuel than we did before, but it could not be made to dry more than one-half of the lumps produced by the press. The plan was abandoned, and I was authorized to experiment with coal dust and coal-tar pitch.

The cement which is used in Europe to conglomerate coal dust, is usually dry pitch, which is prepared by separating from the tar, at a temperature of 572° Fahr., the volatile matters which it contains. Some manufacturers, however, employ crude tar, others a rich tar, which has been cleared of 25% of its volatile substances, by heating it to 392° Fahr. But, with common tar, very weak fuels are obtained, which do not burn well, and give out a strong smell and a great deal of smoke; it is also necessary to subject them to a baking process, in order to solidify them, and to eliminate the more volatile of the materials contained. This operation, of course, requires a special plant, the cost of which increases sensibly the price of manufacture, without counting the products which are lost, and which have an industrial value. The crude coal tar is also very inferior to the dry pitch, which can be broken and even pulverized when cold, and be thoroughly mixed with the coal dust. This produces briquettes that give off very little smell.

The massing of the coal dust and pitch is usually carried on in a vertical cylinder, into which the coal dust and pitch are charged continuously and automatically. These substances are heated gradually in the cylinder, or mixer by jets of steam which are discharged upon them from all sides; they are then triturated and amalgamated by a series of blades fixed on a vertical shaft. Arriving at the bottom of the cylinder, the materials are discharged in a pasty condition, through openings from which they are placed or conveyed to the moulds.

In order to obtain a good lump from this paste, the pressure must be at least 3000 lbs. per square inch, and in certain cases, with hard or lean coal, it is necessary to increase this by 50 per cent. This heavy pressure is required by the nature of the paste, in order to expel the water which it contains and to bring it to compact condition.

In European mixers the steam injected into the materials escapes with difficulty and condenses rapidly, hence the moisture in the mixture, which is only expelled by strong pressure.

When steam is injected through perforations into the materials to be mixed, it loses in reality its pressure, that is the tendency to push asunder the sides of its containing vessel, but at the same time it produces a temperature corresponding to a considerable pressure. Steam gives up first its latent heat, and then, after suffering condensation, a portion of its free heat corresponding to the difference of temperature, and the mass thus becomes continually heated. This, however, requires time, and it occurred to me that if I could dry the coal dust first, bring the same to a certain degree of heat, and mix it with coal tar pitch, in a molten state, I would obtain more rapidly a plastic mixture, which could be moulded by the same rollers, used previously to mould the mixture of coal dust and clay.

I was well aware that my mixer was not the right apparatus to mix rapidly coal dust and melted pitch, but I had seen at work a mixer, invented by Mr. August Dietz, of Philadelphia, for the mixing of sand and asphaltum for paving purposes, and I had no doubt that it could be modified to answer my purpose.

Before obtaining the means to make the required alterations to the plant, I had to demonstrate the possibility of making the fuel in that way. I made that demonstration in a very primitive way. I hired two men engaged in the tar and gravel roofing business, and had them melt the pitch in the yard and hoist it up in buckets, from which I dipped the pitch with a gallon measure and emptied the same into the mixer. A certain quantity of coal dust, previously heated, had before this been discharged into the mixer. In the bottom of said mixer, I had placed a steam pipe, 1″ in diameter, with perforations of ⅛″ through which I injected steam into the materials, until they were brought to a plastic condition, when I gradually discharged them into the hopper of the press and moulded the same without difficulty.

The moulding rollers are hollow so as to enable us to warm them by steam. As I had no steam connections made, in order to prevent the adhesion of the materials to the rollers, the moulds were lubricated by means of two tin pans, filled with water, placed underneath each roller, and in which each roller revolved to a certain depth.

The lumps were very hard, the demonstration seemed to be conclusive, at least it appeared so to one of our stockholders, who offered to make the required alterations at his own risk, if he was allowed to try a mixer of an open one, as we have now. The pitch acquires its cementing properties from 170° to 212° Fahr.; below 170° it loses them. When exposed to the atmosphere, the mixture chills gradually, and when the pitch coating of the particles of coal is chilled it prevents the perfect adhesion of those particles under pressure. While the pressed lumps are still warm, their surface is smooth and the chilled particles apparently adhere; but when the lumps are cool the rubbing of one lump against another sets loose those chilled particles which accumulate and create dust again in the coal pockets, in the carts, and in the cellars of the customers. This defect, however, can be easily remedied by replacing the open conveyer under the mixer by a closed one, and heating the moulding rollers with steam.

In Dietz's mixer are two horizontal shafts, to which are clamped a series of blades, placed at opposed angles, and which make thirty-five revolutions in one minute. When the materials are mixed, they are dropped into the conveyor underneath, through apertures in the bottom of the mixer, which are opened and closed by means of sliding doors, operated by a lever. In this conveyor the materials are carried forward towards the hopper of the press, by blades placed at the same angle on two horizontal shafts which he had devised and which, he thought, would answer my purpose as well as Dietz's mixer. The attempt was not a successful one, and as our means were nearly exhausted, I had but a poor chance of carrying out my plans, when another stockholder came in who approved those plans of mine and offered to apply them, on certain terms and conditions, which were accepted by the company.

There is a rule attributed to Bacon, which says, "Begin with observation, go on with experiments, and, supported by both, try to find a law and a cause." I tried my best to apply that rule. The man who is experimenting and wants to have absolute facts to work upon, is often made to doubt his own sagacity and capability, for he must often change his course of action by reason of deductions drawn from experiments. It so happened with me. I had carefully planned with Mr. Dietz all the details of his mixing machine in order to adapt it for our purpose. Still I had lost sight of one essential point, and that was to keep the materials, when mixed and brought to a plastic condition, in a hot condition in a closed conveyer instead also, but which make only 3½ revolutions per minute. With this mixer a quantity of materials weighing a little over 1,000 pounds is mixed and brought to a plastic condition, ready to be moulded in the short space of 2½ minutes. The coal and the pitch are both measured, and the proportions are 9 per cent. of pitch to 91 per cent of coal dust.

The moulding press is composed of two rollers, geared together, and on the periphery of which are milled out a series of semi-oval cavities, connected with one another, in order to facilitate the dropping of the lumps from the moulds, on an endless belt placed underneath.

The efficacy of moulding rollers is not accidental or arbitrary, but is governed by certain rules, which may be determined on mathematical principles, if not with perfect exactitude, at least with a tolerable degree of accuracy.

Moulding rollers accomplish the compression of materials more by a squeezing or bruising action. They possess the great advantage of squeezing the materials, so that the feed is only a short time between the rollers. This advantage is a very important one, and it will not be surprising if rollers, as a matter of fact, are destined hereafter to play a great part in the manufacture of artificial fuel.

If we follow the materials in their passage through two rotating rollers, we find that they are seized by the power of adhesion at a certain point, depending partly on the dimensions of the rollers and partly on the size of the lump. The particles of coal, coated with pitch, receive no pressure at the first point of contact from the face of the rollers, but from the drawing-in action of the two revolving rollers. The squeezing pressure, which is thus exerted on the materials, is produced entirely by the gear of the rollers; because, through the rotating motion, and by being carried forward by its power of adhesion, the plastic mixture is drawn into a gradually decreasing compass, and must be squeezed and moulded. This reduction takes place regularly; both rollers possessing an equal speed. The speed being equal, the product leaves the rollers in the shape given by the moulds.

If the arrangement of the compressing rollers is such that they may be approached to one another at will, by means of springs, the first result must be a diminution of the amount of power required in comparison with the rollers with fixed pressure.

The feeding of the materials will also be more regular, and the danger of breakages from pieces of iron, stones, etc., which are often found in the coal dust, will be avoided, the springs giving way to allow the passage of those pieces of iron, etc. through the rollers. It is to be regretted that our rollers are brought together by means of screws instead of springs.

The great difficulty is the regulating of the feed. Rollers of large diameter draw in the feed better than those of a smaller diameter. The feed ought to enter under the regulating diaphragm along the whole length of the rollers in an even stream; still, this cannot always be the case, because the stream of materials is not even. A certain friction takes place between the particles of coal and pitch, because the proportion of pressure on the particles of the feed in the middle varies from the pressure exerted on the particles next the rollers, the latter being more compressed and sometimes crushed. The entry of the feed should, therefore, not be forced; for, in this case, either a portion of it will pass through the rollers not sufficiently compressed, or a stronger pressure will have to be employed, which would alter the result desired, and would produce lumps sufficiently compact to resist rough handling without breaking, but not sufficiently porous to insure free combustion without a blast or a strong draught.

The greatest difficulty in the moulding of the coal and pitch was to obtain a regular feeding of materials, and to prevent the accumulation of materials which solidified in the hopper of the press. These accumulations prevented also the regular delivery of the materials between the rollers. I suc-

Boiler of Silsby Fire Engine—See Page 5.

ceeded in this by a very simple contrivance, which works perfectly.

The coal dust is dried and heated by two sets of four revolving drums, which answer well enough in dry weather, but when the coal is very wet we have some difficulty, and we are unable to dry and to warm a quantity of coal sufficient to keep the mixer and the press running. This defect, however, can be easily remedied by increasing the size of the outlets for the escape of the moisture evaporated from the coal.

The defects of the present plant could have been corrected long ago had I had the opportunity of carrying out my ideas. Through force of circumstances, I was compelled to allow others to try plans of their own. The result was expensive, unsatisfactory and unsuccessful experiments, the legitimate outgrowth of which was disappointment, disagreement, loss of time, of money and of production. At last, however, I was allowed to have my own way, and the result was a success, although obtained with imperfect means.

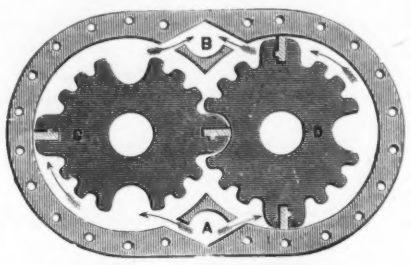
The coal was placed in the market by myself, and I introduced it, from the start, for domestic use. It was supposed that the smoke and the strong smell of the burning pitch would be a serious objection to its use, but by careful instructions given to the customers, the inconvenience from the smell and smoke was hardly perceptible to those who followed those instructions.

While experimenting with the fuel in different heating apparatus, I ascertained that when the lumps were but half consumed, the poker was handled roughly, the particles of coal would disintegrate and would fall, unconsumed, through the grate bars into the ash-pans, seemingly increasing the quantity of ashes, but in reality losing the heating power of the unconsumed coal. This was caused when the lumps were red hot to a depth of about a quarter of an inch. Each lump would then become, so to say, a small retort. The pitch which held the particles of coal together, in the center of the lump, would gradually be drawn through the red hot crust of the lump, it would be consumed, and when the lump itself was partly burnt and reduced to about one-third of its volume, there was not sufficient pitch left in that nucleus to keep the particles of coal together until they were consumed.

In order to remedy this very serious defect I mixed with the anthracite coal dust, about 8 per cent. of powdered bituminous coal. The result was a better fuel, which did not disintegrate, coked in the fire, and was almost entirely consumed, leaving but a small quantity of ashes, when compared with the fuel made from anthracite, without the addition of bituminous.

This last fuel has found a ready market. It ignites readily, lasts as long as the ordinary anthracite coal, and it does not clinker. A good many of those who have tried it, do not wish any other, and they send in new orders, whenever their supply is exhausted.

It has been the main object of all inventors of machinery for the manufacture of artificial fuel, to obtain a large production in lumps of a small size. It is easy to obtain a large production in lumps of a large size, and no better machine has yet been devised to obtain a large production than that described by Dr. Grimshaw in the *Journal of the Franklin Institute*, of September, 1879, and which is manufactured in France by the "Société Nouvelle des Forges et Chantiers de la Méditerranée." The production of a double machine, of the smallest size, does not exceed 96 tons in 24 hours, in lumps weighing very near three pounds. My press will manufacture in one hour 13 tons of lumps, weighing only 2½ ounces each. Those lumps require no drying or baking. They are conveyed to a screen in eight minutes, and that time is sufficient to cool the lumps.

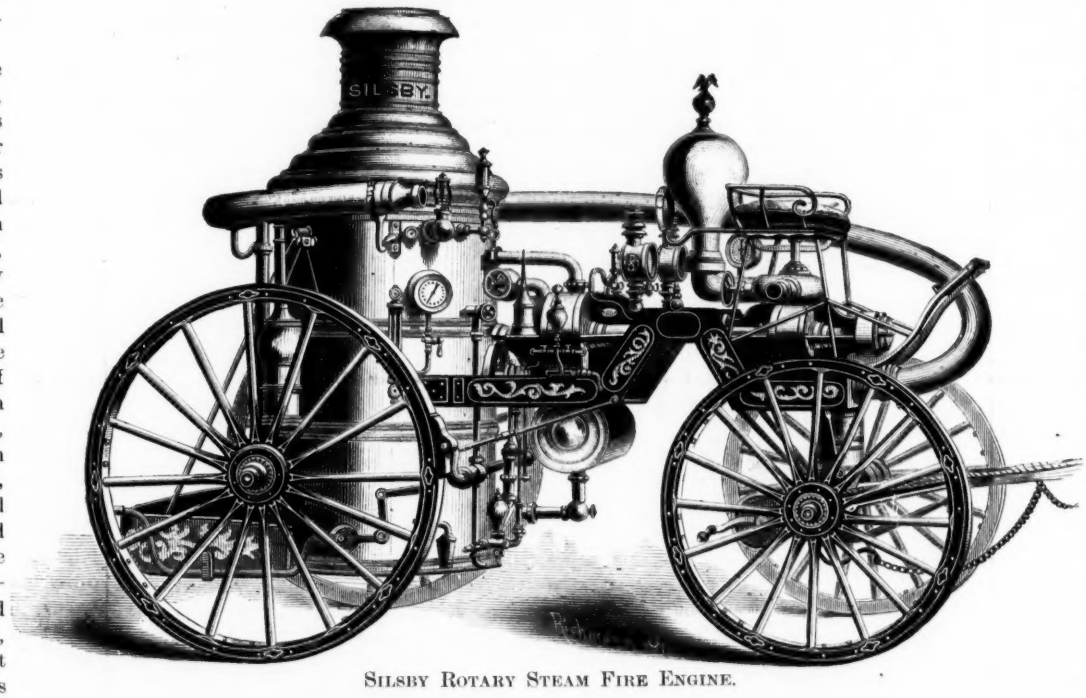


SECTION OF FIRE ENGINE.

They are then ready for delivery. The pressed fuel would be much improved if the coal dust was previously washed, and in the erection of new works it will be essential to provide washing apparatus for that purpose.

The difficulty now seems to be to secure a sufficient supply of coal dust at the shipping points, and as there is a market for pea and dust, the coal companies do not feel inclined to dispose in our favor of the dust proper, so as to enable us to manufacture a fuel which would compete with their own coal. The successful manufacture of the pressed fuel being, however, a demonstrated fact, it will evidently be in the interest of the large companies to erect machinery to utilize the coal dust, instead of piling it up around the mines. Whether the manufacture of the pressed fuel is carried on by us, or by the coal companies, the community at large will be benefited by the utilization of coal dust, which was considered, until recently, a worthless material.

I have struggled during twelve years to obtain that result; I persevered under the most trying circumstances, having to overcome financial as well as mechanical difficulties. I am satisfied, now, that very little remains to be accomplished in order to make the manufacture of pressed fuel from coal dust one of the most important industries of Pennsylvania.



SILSBY ROTARY STEAM FIRE ENGINE.

Improved Rotary Steam Fire Engine.

We illustrate herewith in general view and in sectional detail, one of the most improved types of American steam fire engines, made by Silsby Mfg. Co., Seneca Falls, N.Y. This machine is characterized by all that elegance of design and finish, and strength in its working parts, for which the steam fire engines of this country are noted. The peculiar exigencies of fire service in a new and reckless country like ours, constructing so largely in wood, exact of a steam fire engine, for our use, a remarkable degree of lightness, strength and strong forcing power, with ability to resist bad use and neglect. In the general view of the engine, here illustrated, it will be seen that the boiler is hung very low to avoid overturning in going round sharp corners, in which last the makers are aided by the adoption of that form of frame known as the "crane-neck," heretofore applied only to reciprocating engines having vertical steam cylinders and pumps. The suction hose is always attached in front—"squirrel-tail" fashion—enabling quick coupling up to the hydrant. By placing the air chamber well back, the driver's seat is not perched up dangerously high. The boiler, which is seen in section, is both tubular and tubulous; that is, has fire-flues, open at both ends, and suspended water tubes of graduated lengths. These last are on the so-called "Field" plan, so well known in England and really invented by Jacob Perkins, and insure most rapid, positive, and effective circulation and quick steam generation. One of these tubes is seen in enlarged view in lengthwise and cross sections.

The engine has two rotary pistons *C, D*, each with two long spring-packed toes, and two recesses accommodating those of its mate; and accurate presentation of these toes is ensured by gear teeth on the remainder of the piston periphery, and by spur wheels on the shafts outside the casing. The steam enters at *A*, and produces rapid rotation of both pistons in opposite directions, escaping at *B*.

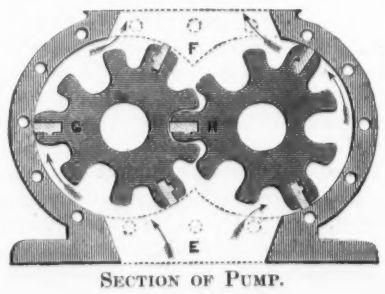
The pump is on the same general principle, save that there are now given it three toes on each piston, *G, H*. *E* is the suction side; *F* the discharge. Increasing the number of toes steadies the stream of water.

The boiler may be fed from the main pump, or from a "doctor."

The peculiar advantages of this build of engine are quick steaming, steadiness and force of water supply, and ability to play during the largest and fiercest conflagration without stoppage to take up lost motion. The steady stream of a rotary engine is much easier on hose than the pulsating stream of a reciprocating engine, and the jet falls and remains with precision where directed, without throwing the pipemen round.

Advances in Wages.

Several of the corporations in the vicinity of Port Henry, N. Y., including the Iron Ore Company, have already advanced, or will shortly advance, the wages of employees.



SECTION OF PUMP.

The Delaware and Hudson Canal Company raised the pay of shop men ten per cent., to take effect March 1.

All of the employees at the Himrod furnace, Youngstown, Ohio, will be paid off at an advance of ten cents per day from Feb. 1, 1880.

The foundrymen of Vineland, N. J., who have been on strike for an advance of 25 per cent., have compromised with their employers and gone to work at a 20 per cent. advance.

The Logan Iron Company, at Lewistown, Pa., has advanced the wages of puddlers from $4.50 to $5.25.

Brown, Bonnell & Co., of Youngstown, O., lead off in that section with an advance in the wages of laborers and watchmen in their employ. Those now earning $1.35 per day are advanced to $1.50. Other laborers who are at present receiving $1.50 or more per day have been advanced ten per cent.

The employees at French's spring works, Pittsburgh, Pa., have received an advance in wages of about 15 per cent.

All the miners in the Shenango Valley have received an advance of ten cents per ton for mining.

The striking hands in Vernon Bros. shirt factory at Mount Vernon, N. J., have resumed work. The demand for an increase of wages was acceded to. The strikers were mostly Chinamen.

The Easton, N. J., *Express* reports that the hands at the Warren foundry are to receive an advance of ten per cent., and the men at the stove works have commenced working ten hours a day.

On Monday, March 1st, the wages of puddlers at the Phœnix Iron Works, Phœnixville, Pa., were advanced from $4.50 to $5 per ton.

The wages of the puddlers in the rolling mill at Cohoes, N. Y., will be raised from $4.25 to $5 per ton.

An increase of wages on the Manchester, N. H., corporation has been announced to commence March 1. Other corporations will probably follow suit.

The Pittsburg manufacturers have given the lamp-chimney blowers an advance of 15 per cent., bringing their wages up to $4 a day.

Saturday last being pay day at the Union foundry, at Rockaway, N. J., the employés were surprised by receiving a raise of 12½ per ct. on their wages. The advance was appreciated more, for the men had not asked for it, and were not expecting it.—*Asbury Park Journal.*

The cotton-mill at Rockport, Mass., has increased the wages of its employees.

The Lyman Mills corporation, of Holyoke, Mass., have raised the pay of their help 10 per cent. It will make a difference of $3,000 in their monthly pay-roll.

Technical Schools in Prisons.

We learn from the *Boston Commercial Bulletin* that Mr. Edward Atkinson, at the request of Mass. Legislative Committee on Prisons, has prepared a pamphlet with reasons for recommending the adoption of a system of instruction in the mechanic arts in prisons and reform schools. The plan seems to provide for complete technical schools in penal institutions.

His idea comprehends a course of elementary instruction in carpentry, blacksmith, foundry and vise work, brazing and molding, wood and metal turning and metal finishing, under charge of a small corps of competent instructors. The cost of such a building, for an institution containing nearly four hundred inmates, together with machinery and tools is estimated at about $30,000. Mr. Atkinson has made a careful study of the subject and presents some very cogent reasons for the adoption of the plan.

The new Chinese Encyclopedia is now published, and ready for subscribers. This interesting work consists of 5,020 volumes, and is sold complete for $7,500.

Green Sand for Cores.

BY FRANK C. SMITH.

Where a considerable number of cored pieces are to be cast in a foundry, the making of the cores of dry sand is probably as expensive an item as any of the other portions of the process of founding. The making of the plain cores of green sand is a great advantage to the foundry man, as he saves time and core sand. The use of green sand cores necessitates special core bars. Thus, Fig. 1 shows a core bar for a pipe. The bar is made of cast iron, cast in one piece. The end pieces *a*, are of the same diameter as the core when finished, the wings *c*, serving as "lifters," and the projections *b b b*, Figs. 1 and 3, steadying the top half of the core. Only one-half a core box is used. *B*, in Fig. 3 is the half core box, which, when used is laid on the foundry floor, and green sand riddled into it deep enough for the wings on the core bar to partially "bed."

The core bar having been "clay-washed," is laid in the box, the ends *a*, resting on, and filling up the half circle, as shown. The "vent" cores *e e*, Fig. 1, are then slipped through the holes in the end pieces *a a*, more sand is riddled on the bar, the wings "tucked" and more sand added; the top half is "rammed up" with the hands alone, something larger than the end pieces *a*. *C*, Fig. 3, shows the core as it now appears. A "strike," Fig. 2, which is simply a board having the circle of the core cut out and faced with $\frac{1}{8}$th inch iron, and a guide piece *a*, is then applied, as shown in Fig. 3, *D* being the "strike," and *a* the guide piece, and *E* a portion of the core "struck off." The bottom edge of the "strike" resting on the top face of the core box. When the core is "struck off" it may be "slicked" with the trowel, the "vent wires" *e e*, withdrawn, and the core lifted out of the box by the handles *f f*, and "set" in the mould which is then ready for pouring.

In making cast-iron pipe "T's" a similar core bar is used, as in fact, in all green sand cores of whatever shape.

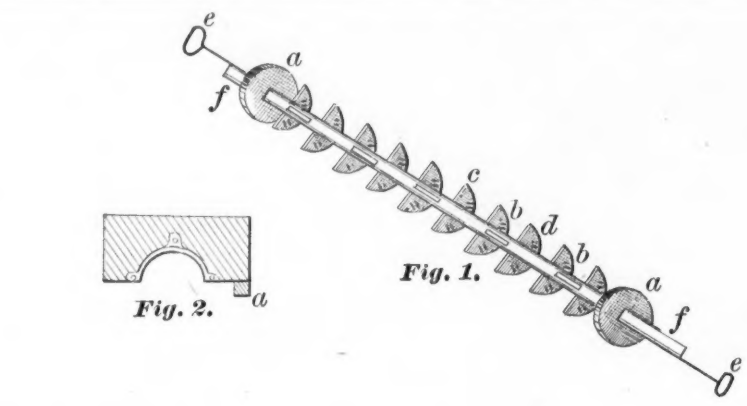
In Fig. 4 the "legs" of the "T" core *A B C*, are "struck off" with a full $\frac{1}{8}$ circle "strike," from *a b c*, the portion *D* between *b* and *c*, with a $\frac{1}{4}$ circle "strike" as shown in Fig. 5. The balance is brought down to shape by the trowel, using the portions already struck as a guide. This is very quickly accomplished, in fact much quicker than a person would believe, unless he had used green sand cores before.

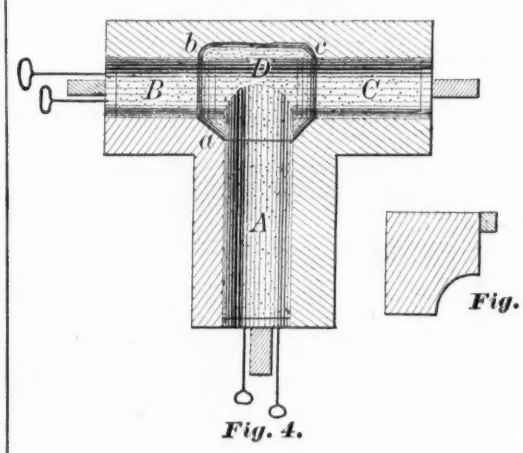
Fig. 6 shows an elbow core in the box. The "strike" *A*, for the curve has the guide piece *c*, fitted to same curvature as *b b*. The vent wires *e e e e*, run through the elbow as shown at *a a*, and when withdrawn the holes left at *a a*, in the elbow are "stopped off." The ends of an elbow core must be long enough to balance the curved part (unless large spikes, or some similar article, is pushed in the sand after the core is set over the handles *f f*, to keep ends of core down). No "anchors" or "chaplets" can be used, the core being prevented from "coping" or floating up when poured, by the stiffness of the core bar.

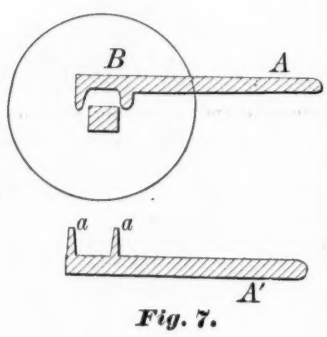
In setting an elbow core it is necessary to use a short wrench *A*, in Fig. 7, *A*, being top view of same, having two "teats" *a a*, which slip into the vent holes in the end pieces of the core bar. *B* is the end piece, and *A* the wrench in position. This wrench is necessary to prevent the core from turning, as it cannot be handled, nor set with straps. The wrench *A*, is slipped into the holes and held by one hand, the handle *f*, being held by the other (two persons being employed in setting the core).

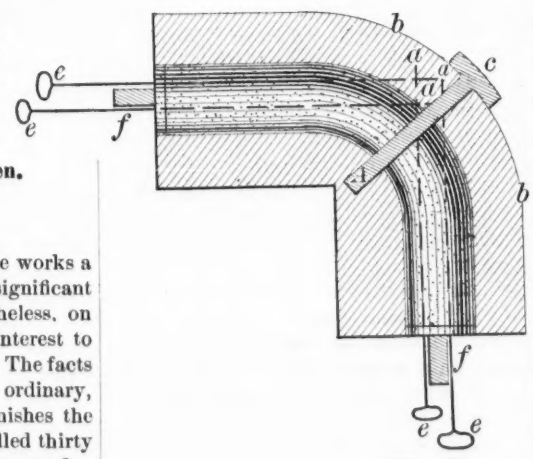
The advantages of a green sand core are plain to be seen. They can be used where all other plain dry sand cores have been used. They can be made almost any size from an inch in diameter up to 24 inches or over. The moulder or a "cub" makes them, "setting" at once when the mould is finished. Thus moulds are not kept open half a day, running the risk of dropping out when closed or having a clamp, or a shovel of sand thrown into them accidentally. They require no flour, molasses, sour beer, or horse manure, no drying, and the sand is not lost. Two or three taps with a hammer on the casting and the bar can be pulled out. No punching and driving for half a day with a sledge is necessary. They leave a hole as smooth and clean as the outside of the casting, and should, of course, when the piece is heavy, be "faced" same as the mould.

They are, however, only applicable when a sufficient number of pieces are to be made, to justify the expense of core bars, "strikes," etc., but where shops are running year in and year out on one kind of work, their use cannot be appreciated until tried.









Letters from Practical Men.

Editor American Machinist:

A circumstance happened at these works a short time since, which, though insignificant in itself at first sight, may nevertheless, on examination, prove to be of some interest to engineers, machinists and experts. The facts of the case are as follows: An ordinary, horizontal, slide-valve engine furnishes the motive power. It is what was called thirty years ago, when it was built, a twenty-five horse-power engine. It has a positive cut-off, or what is termed "lap on the valve," which cuts off the steam at half stroke. The working pressure is 45 pounds per square inch. It has been always admired for its beautiful proportions and fine finish, and, though it would not compare favorably with modern engines of the same type, it is admitted by good judges to be a very creditable job for those times; the tools, experience, and mechanical skill being considered. But it is the governor that forms the subject of the present remarks. It is one of the ordinary, centrifugal, fly-ball type. The spindle is one inch in diameter; it passes down through an ornamental column twenty inches in height, which serves as a guide, through the upper flange of the bed-plate, and rests on a convex step in the lower flange of the latter. It is fifty-one inches from the step to the point of suspension of the arms, to which the balls are attached.

The length of the arms, including the balls, is twenty-one-and-one-quarter inches. There are a pair of braces which are attached to the sleeve, which contains the split-ring and yoke. They are eleven and one-quarter inches between their centers, and are attached to the governor-arms seven inches below the point of suspension of the latter. The lever to which the governor communicates motion, is five feet nine-and-one-half inches. It is forty-eight inches between the center of the sleeve on the governor-spindle to the fulcrum, and twenty-one-and-one-half inches from the fulcrum to the point to which it is connected with the throttle-valve. The whole weight of the governor, balls, arms, braces, spindle, sleeve, lever, and bolts is ninety-one pounds. The throttle-valve is of the ordinary kind, something similar to the damper in a stove-pipe. Every thing was in good order before the accident. There was no lost motion in any part of the governor, but, in consequence of three of the cogs in one of the miter gears by which it was driven becoming broken, it became necessary to take it off for repairs.

Now, as it would take several days to give the governor an overhauling, and as it was absolutely necessary to continue to run (the load on the engine being nearly uniform all day), the throttle-valve was thrown wide open and made stationary, after which it was discovered that the engine drove the same amount of machinery with ten pounds per square inch, less boiler pressure, than it did when the governor was on. The engineer was told to throw the valve on the steam pipe wide open, and regulate the draught so as to maintain a uniform pressure on the gauge. There was little or no difficulty experienced in maintaining a uniform pressure, and consequently a uniform speed, except when it became necessary to use the circular saw for sawing cord wood when the engine would lag below its regular speed two or three strokes per minute. It required a quarter of a ton less coal a week to do the same amount of work than when the governor was on. I would like to have some of our experts enlighten us as to the probable cause of the diminution of the fuel consumption, whether it may be attributed to the power absorbed in driving the governor, or to the loss of pressure induced by the steam having to ooze, first through the throttle-valve, and then through the small port opening admitted by the cut-off.

STEPHEN ROPER.

STEAM POWER AND ECONOMY IN SAWING LUMBER.

Editor American Machinist:

In a recent number of your valuable journal I noticed a letter headed "Machinery in Lumber Mills," which, on perusing, struck me as being rather misleading in some of its statements, if taken literally, besides savoring of "old fogyism."

In the first paragraph, the writer accuses you of an omission in your title page. Well, what is a millwright? A millwright is one who constructs mills, and mills now-a-days are unquestionably constructed by engineers, machinists, blacksmiths, pattern makers and founders. In fact, the word millwright is nearly, and should be quite, obsolete, and properly belongs to the days when a man who had a superficial knowledge of and a certain small amount of dexterity in each of the above branches, was privileged to waste his employer's time, and very often his material also, under this synonym for a jack-of-all-trades.

If Mr. Lanagan means by the efficiency of the mills the ratio of sawdust to the amount of boards produced, I have not the slightest doubt that his statement of its not being "surpassed in the world" is quite correct. "Slaughtered in first-class shape" is a very felicitous expression, and describes the condition of things wonderfully well when nearly twenty-five per centum of the timber is sacrificed to convert the remainder into boards. And I am sure that when the magnitude and importance of the lumber trade is better realized, and the finer grades of lumber become more and more scarce and difficult to find at a reasonable price, engineers and mechanics (not millwrights) will wonder why it is necessary to project such a large proportion of valuable material from the periphery of a circular saw—even if it is the best machine for slaughtering a large log crop in first-class style.

Again, it is stated that no engines used in Muskegon are under 22″×30″. I wonder what has become of all the engines under that size which, to my personal knowledge, used to be there. I remember not over eight years ago having eleven pistons at one time in for repairs from nearly as many different mills in that town, and I also remember that ten out of the eleven were under 22″ diameter—some of them considerably under. Muskegon must have undergone a wonderful revolution in the saw-mills in a very short time.

The horse power seems to be very small for the number of mills given (thirty four) with such large engines. Let us see how it figures up. A pony gang-saw, driven direct with a 16″×20″ engine, will make 175 revolutions per minute, and the average pressure will be 50 lbs. per square inch. This gives $\frac{175\times3\frac{1}{2}\times50\times201}{33000}=177.5$ H.P. Then, again, one of the 22″×30″ cylinders driving a circular machine, edgers, muley or any other machines necessary, would be at 100 revolutions per minute and the same average pressure $\frac{500\times50\times380}{33000}=287.87$ H.P., making the power of what one would suppose an average

sized mill 465½ horse power indicated. Then, taking this thirty-four times gives 15,827, or nearly double Mr. Lanagan's estimate of the amount.

It would be very useful as well as instructive, if a series of indicator diagrams could be taken during an average day's work in a good mill, with both gang and circular saws. The indicator cards should be taken when the saws are in cut, so as to get the power required to cut the lumber; not that required to run the empty mills. I think there is no reliable data published on this point, although it is stated by Nystrom that 3-horse power will cut 100 square feet of pine lumber per hour; but exhaustive data on the subject, such as Mr. Lanagan could get easily, would be very valuable to the profession, especially if exact measurements of the material were given, both before and after manipulation.

I certainly can't see the connection between the "steam-feed" and the heavy cut of 1879, as the introduction of that is at the most an auxiliary matter; and where economy of fuel is no object, as in Muskegon, it sinks into insignificance compared with the many other causes which might operate to produce the heavy cut.

I have one word more to say as regards economy of production and waste of material. Muskegon, as she is blessed with a goodly supply of fuel, might do a great deal more than she has done, not in the way of increasing her cut of timber, but in utilizing the edgings and waste from the mills. In the Saginaw Valley salt evaporation gets rid of a great amount of superfluous energy in the shape of fuel; but I am afraid that Muskegon has been throwing away a great deal of money in trying to burn up the mill waste merely to get rid of it.

A great deal more might be said on this subject, but I merely wish to draw attention to it, as I feel convinced there is a large field for improvement. David N. Melvin.

Linoleumville, S. I., N. Y.

THE MECHANICAL ENGINEER WORKING UNDER DIFFICULTIES.

The Editor of American Machinist:

I think "Chordal" has hit the nail on the head this week (issue of 28th), when he mentions the trials of a mechanical engineer. They are often hampered and dictated to in their work, and confined to such limits that nothing but hard study can make any kind of a show.

I have in mind a case where a number of rolls were required 6″ diameter 5′ long for a hot canvas on a steam drier to run over. It was planned to make them of iron pipe in the usual way. In comes Mr. Dictator; says iron rolls are not needed. "Why, they will cost more than wood," was the only fault found. "Well, how will you have them made?" "Just take a stick of wood and drive some iron pins in the ends, they will do just as well." It was suggested when a hot canvas is placed on these rolls that they will be subjected to a drying process that will check and split them in less than a week, and then they will have to be repaired; this necessitates more expense and delay. The "pins" in the ends will work loose in a short time, and the shaft *must* go through the entire length of the roll. "Well, put the shaft through, but make them of wood anyway." So wood kiln-dried was used. An iron ring was placed on each end of the roll, and they ran nearly three days before they begun to fail. Altogether, more has been spent on them and lost by delay than a good set of iron rolls would have cost at the start. Now, who is to blame for the failure? It does look curious that a company will employ a mechanic because they know they must have one, and at the same time ignore the fact that he is of no use to them when they compel him to use their ideas only. Why not save his wages and let him go? It would be better for both. J. E. Stannard.

Springfield, Mass.

PROBLEM IN SCREW CUTTING.

Mr. Editor:

A problem in screw cutting was brought to my notice a few days since, which may exercise the minds of some of your readers if you should choose to lay it before them.

Required: Compound gearing to cut a thread of 1½ inch pitch; the feed screw of lathe has 5 threads to the inch. Resp't'ly,

Chicago, Ill. C. A. Hague.

Type-Setting and Distributing Machinery —What has been Accomplished.

BY WILLIAM A. LORENZ.

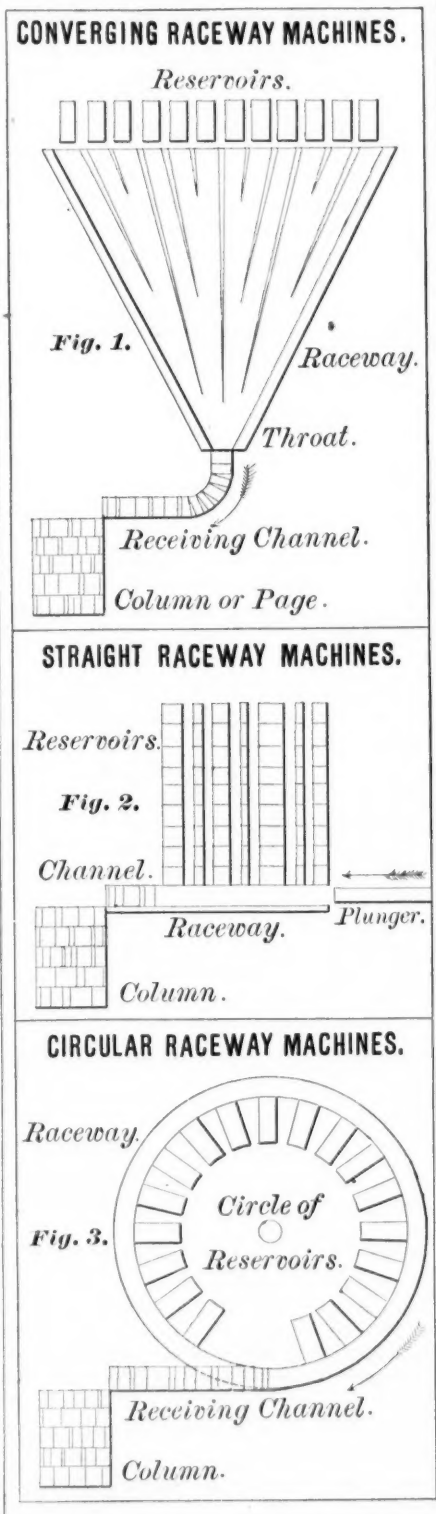
The mechanics of type-setting dates back to 1822, when Wm. Church started on the marvelously thorny road since trodden by many men, whose ambition and faith have led them on in this department of mechanics. Among the 130 different patents issued in the United States and Great Britain, the machines of Mitchel, Alden, Houston, Brown, Dickinson, and Delcambre; Young, Rosenberg, Hattersley, Mackie, Kastenbein, and Fraser are prominent. These should be guides to every man now engaged in building type-setting machinery.

Type-setting machines are at work to-day in Great Britain, in Germany, and in New York. The London *Times* uses some type-setting machinery. The Government printing office at Berlin has tried the Kastenbein machines, but Mr. Kastenbein acknowledges to a speed of only 60,000 type in ten hours for four men. The machines now running in New York, and owned by H. A. Burr, were fathered by S. W. Green for many years, and through his energy and perseverance, they prove what can be done in machine type-setting. The originals of these machines were invented by C. W. Dickinson, and the writer had the charge of perfecting them, and of constructing their followers, during several years, being greatly assisted by L. K. Johnson, and E. G. Parkhurst. What they have actually accomplished is of interest. The 26 machines are in pairs—13 setters, and 13 distributers—an operator and a justifier working each setter, and a boy attending each distributer. Over the whole set a machinist is in charge, with two boys to look after cases and type. The machines run from small pica to brevier type, each machine taking two different sizes. The operators take all miscellaneous copy, wide and narrow measure, leaded and solid, and work is done by the piece. For a period of 18 weeks, ending Aug. 16th, 1879, there were set upon 7 pairs of machines 27,761,957 ems in 7,240 hours, or 38,345 ems (92,028 type) per day, per machine, at a cost of 20⅝ cents per 1,000 ems, counting all expenses. This is taking all operators together, new and old, good and bad. The best ten hours' work for one pair of operators was 56,000 ems (134,400 type) on solid, and 71,850 ems on leaded work. These machines have now been running two years, and have set over 100,000,000 ems. They were built at the Pratt & Whitney Works, Hartford, Conn., and are excellently made.

Two methods of building machinery for composing, which takes the place of both types and type-setting, are prominent. One is a stereotype or matrix machine, which by means of keys impresses the desired composition into a yielding substance. Plates are then secured from this matrix, and used for printing. This system has little chance of success because of the irregularity of the impressions, the difficulty of correcting and justifying, the great cost of the entire range of key punches, and the accumulation of dirt in using them. In the second method, letters are printed by a type-writer on a strip of paper, which is photographed and transformed into a plate for printing. This process is slow and costly, and the composition has not been good.

The next form which type-setting machinery takes, comprises the casting setter, which casts types and sets them up in line, ready for justifying, and the casting distributer, which casts types and sets them in different reservoirs, ready for the composing machine. Of both these machines several have been attempted, and have invariably failed. They are too slow, and the types produced are not uniformly perfect. At the rate the machine runs, say 35 type a minute, it will take 8 machines, 8 operators, and 4 justifiers five hours to compose the first page of the New York Daily *Times*.

Machines employing perforated bands of paper, by which both the composing of the type, and its subsequent distribution are done automatically; have been built, and these approach closely to the ideal of an automaton. That they are a mechanical possibility on average type, I believe, but that they can ever be commercially successful is certainly doubtful. For this reason, the labor necessary to punch the strip of paper should have composed the matter. Newspapers setting type with such machinery could not wait to have the paper strips and also the composed matter proof-read and corrected. As a distributer the machine can not be practically used, for one alteration in the justifying or correction destroys the sequence in the perforated strip of paper.



Next comes the largest class of all, viz: type-setting and distributing machines, which use ordinary type. The elements in a setter of this kind are: reservoirs, key-action, raceway, receiving-channel and galley. In a distributer the elements are: galley, feed-channel, feed-mechanism, raceway, selecting-mechanism and reservoirs. The *raceway* of any machine is its distinguishing feature, and through the raceway the types are transferred from the reservoirs to the composed line, or *vice versa* Raceways are *converging*, *straight*, or *circular*.

A converging raceway setter (Fig. 1) assembles the types by gravity or power through a converging raceway and throat, to a receiving-channel. The raceway may be a smooth plate, or a carrying belt, or apron with diagonal side-plates or belts; and it may be horizontal or inclined, or it may be a grooved plate inclined or vertical, covered or uncovered. A converging raceway distributer guides the types from a page, through a reversed converging raceway, to their proper reservoirs.

A straight raceway setter (Fig. 2) delivers the types directly into a straight raceway, and transfers them into a receiving-channel by belts, plungers, conveyers, atmospheric pressure, or gravity. A straight raceway distributer is the reverse of this setter.

A circular raceway setter (Fig. 3) carries the types from a circle of reservoirs to the receiving-channel. The carrying is done by belts, revolving disks, wheels, grooved barrels, or carriers. A circular raceway distributer is the reverse of this setter.

Reservoirs are the holders from which the types are taken as wanted in the setters, and which are filled in the distributer. They may be single or combined, fixed or removable; may stand vertically or horizontally, or may incline. The types may be placed in the reservoirs side to side, or edge to edge, or end to end; and they may have weights to steady or move them, dropping by gravity, or moving by pushing springs or mechanism.

The *key-action* ejects the types from the setter reservoirs, and separates the types from the page in some distributers. By striking keys on a key-board, this action may work directly, or may give a signal to mechanism that drives out the types singly or in combination; and there may be an alarm to indicate the condition of a reservoir. The ejectors may be in the shape of pushers, releasing clamps, or nippers. An automatic distributer uses no key-action, but, in its stead, a *selecting mechanism*, which selects and extracts the types of different denomination from the raceway. This is accomplished in various ways; one machine feels the type faces; another selects the types by thickness, between jaws, but usually nicks or notches, cut in the type body, are employed. These nicks vary in number, position, size and shape. The selection may be done by mechanism operating on the type and releasing a locking device, or the type may be pressed against wards. The extracting may be done by hooks, ejectors, scrapers, gravity or other force; and the types may be delivered directly into the reservoirs, and there advanced by pushers or cams, or into a reserve, being guided by tubes, belts, or other conductors. In the setter the types arrive in the *receiving-channel* through a throat, where gates, rollers or springs may control them; a pusher, cam, or clamping disk may advance the line in the channel. In the distributor the *feed-channel* takes the place of the receiving-channel. In this feed-channel the single types to be distributed are cut off at one end of the line where an opening is effected, either by key-action, to pass the type of different thicknesses, or the machine may feed out the type automatically, irrespective of thickness. This is the *feed-mechanism*.

The *setter-galley* is the composing-stick, and in it the column is made up; this column may be supported by adjustments on a proof-galley. The type is generally taken from the composed line in the receiving channel, or from numbers of long sticks of type. Some setters have no galley, the type being justified from the composed lines in an ordinary hand composing-stick. The *distributer-galley* may have supporting adjustments and motions to deliver lines of type to the feed-channel.

Various tools and appurtenances are used in connection with type setting machinery: Separators for composed lines on setters; sort-racks to hold extra type; pincers or tubes to transfer type; feeding-sticks to use in hand-distributing; setter-sticks to hold composed lines; space machines to use in justifying and spacing out; spring-spaces to aid in justifying; machine-spaces to use temporarily in justifying; space-arrangers to set up spaces.

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The Wages Question.

The Spring of 1880 opens with more industrial activity and brighter business prospects than any other since the memorable crash of 1873. A few months of steady recuperation of all the great productive and distributive enterprises have served everywhere to give tone and confidence in commercial circles. Labor, the first to feel the pinch of business depression, finds steadier and more profitable employment; while employers who conduct industrial enterprises in which all their accumulated substance is at stake breathe more freely, and venture further than they would have dared to do in the advancement of their business plans at any previous time within the last six years. The commercial situation is one of good cheer and promise both for employers and workmen. But in the full tide of industrial activity an unfortunate and growing contention has sprung up in different localities about the increase of wages. Strikes are becoming more numerous and of greater proportions. Unless present indications fail, the wages problem is to be an unusually troublesome one during the coming season. Trade unions are mustering their forces and preparing for a vigorous campaign to secure a uniform increase of pay for drones and inferior workmen, as well as for those ambitious and progressive. But aside from the bungling work of trade unions, the question of granting generous advances now confronts employers in such a way that it cannot be ignored. During the late years of depression it was often found necessary to reduce workmen's wages, and not a few employers promised at the time these reductions were made to restore the old rates to faithful and competent men as soon as the revival of business would warrant their doing so. In other instances where employers did not commit themselves to any particular course of future action, it was tacitly understood that wages should advance when business should receive a fresh impetus, for reasons directly opposite to those causing the decline. It is decidedly gratifying to observe that manufacturers—especially those of iron and machinery—have early appreciated the desirability of permitting their employees to share, justly, in the benefits of prosperous seasons of business. In some shops, mills and factories, wages have been increased two or three times since the "boom" started off last summer. The cost of living has been considerably augmented; comforts and conveniences for workmen are higher priced; the cost of almost everything required in domestic management has advanced, and it would be out of place to contend that workers for wages should not expect a higher remuneration for their services, inasmuch as the products of their labor command more profitable returns to employers. Where shop owners and workmen are almost daily brought into contact with each other, the question of regulating wages is comparatively easy to meet and dispose of to the general satisfaction of both parties concerned; but where proprietors keep aloof from their employees they cannot, as a rule, understand each other's motives and inclinations, until the smouldering fires of discontent suddenly burst into a serious conflagration, heavily damaging both proprietors and workmen. That the personal interchange of views, between men converting brain and muscle into productive force and those paying for the same, would be a powerful preventive of most of the strikes now taking place, seems plain enough to us, but there are others who have less confidence in the potency of direct reasoning. In reducing as well as in advancing workmen's wages, the plan of doing so by a uniform rate per cent. is open to serious objections. It is the plan pursued by the trade-unions which take no cognizance of individual skill and improvement in contending for higher pay, but endeavor to push forward each and all with equal speed, giving the lazy and incompetent workman the same advance as his more energetic and skillful neighbor. The plan does not promote a high grade of skill, as it provides no reward for special merit. A studious and progresssive mechanic who, by extra efforts, is making his services daily more valuable to his employer, is not likely to feel highly gratified if advances in pay to all in the shop are regularly made upon the percentage plan. The wages system that works most satisfactorily, according to our extended observation, is that which makes the rate dependent upon ability and the showing of practical results, and which makes the agreement between employer and each workman a private transaction, of which his associates need not be informed.

Apprenticeship and the Common School System.

In a late issue of *Scribner's Monthly* the editor, Dr. J. G. Holland, assails the American common school system, so far as it relates to the industrial education of boys, in a way that is suggestive of thought, even if not very orthodox. His idea that the tendencies of common school education and the efforts of trade unions are the two great causes of the decline of the old apprentice system, and the two great and all-powerful obstacles to its restoration, is certainly one that will require a strong array of facts to back it up. In all the lines of employment commonly spoken of as the machinery or machine shop trades, the influence of trade unions upon the number of apprentices in the shops is practically nothing; and a general canvass would show that a large majority of the workmen came into the shops through the open doors of the common school. Yet in these shops the apprentice system has (until very recently, perhaps) fared no better than in the multitude of manufacturing employments outside, some of which Dr. Holland instances, and which use none but routine labor. We suspect that a close analysis of the situation in most manfacturing employments would discover, that the occupations and instances in which the trade unions have power, *really*, to hinder or prevent apprenticeship are by no means the rule, but the exception.

The real root of the difficulty lies in the fact that, in the machinery trades, improved machinery and the system of manufacturing by duplication of parts has changed the plan under which the shops are run. Formerly they *built* machinery; now they *manufacture* it. Formerly no two machines of the same class were alike; now the parts are so similar and so exact that they might almost be sent to any part of the world and put together without further need of tools. In the woodworking and other trades, mentioned by *Scribner*, the same tendency is at work; in all the industrial and mechanical employments of the time it is apparent in greater or less degree. But mistaking the cause of the disease is by no means a safe prescription to take with a view to its cure.

So far as Dr. Holland's view regarding the value of properly conducted industrial schools is concerned, its justice must be conceded But we can see no ground in any aspect of the case for antagonism toward either the value or the tendency of the American common school system. So long as American boys have the idea that the prizes of life are found in professional or mercantile circles, or in the business departments of manufacturing concerns, so long will the tendency to seek their fortunes in those fields be apparent among them. That notions of this sort are to-day so prevalent among American boys is due—not to the system of common school education but, to the absence of technical or industrial school facilities. That there is anything in common school tendencies to unfit bright American boys from entering upon responsible mechanical employments *via* the industrial school or the shops, or both, is a deduction that nobody will be more ready to gainsay than the practical men who gained their training in just this way. The truth is that the rewards that await the trained intellect, in the direction of mechanical, manufacturing and engineering success, are becoming obvious, and to the knowledge of them we owe the agitation of the industrial school question, which is now being made all over the country; to the knowledge of them we owe the organization of local mechanical and engineering societies in so many of our American cities; to the knowledge of them we owe the organization of the National Society of American Mechanical Engineers, which was born the other day in the office of the AMERICAN MACHINIST; to the knowledge of them we owe the able article of Dr. Holland upon Industrial Education, to which this is, in some measure, a reply.

That industrial schools are a necessity of the future is plain; that common schools are also a necessity, the past successes of American mechanics have abundantly shown; that there is any necessary antagonism between the two remains to be proven; that the common schools will be admirable feeders for the industrial schools of the future we firmly believe. The accomplished editor of *Scribner's* desires to have such schools established at public expense. But in farming districts, in seafaring districts, in many mining districts, this would be an impracticable reform. What might, perhaps, be done, would be to enact State laws enabling any local community which desired so to do, to levy and expend a moderate tax for industrial school purposes, additional to that expended for common school uses. Our rich men who have money to give to schools and colleges can do much by giving a moiety for this purpose; but the workmen and the sons of workmen, by turning their faces steadily in the line of mechanical progress, can do more.

Prospects of the New Society.

Every day since its preliminary session has served to brighten the prospects of the new American Society of Mechanical Engineers. The leading daily newspapers of this city, including the *Herald*, *Times* and *World*, published an extended report of the proceedings, characterizing the occasion in most appreciative terms. The substantial unanimity of the daily press has since been most heartily emphasized by the technical and commercial journals of the country, the general feeling being that there is an abundant field for such a society.

Regarding the preliminary meeting which was held on February 16th, at the office of the AMERICAN MACHINIST, our contemporary, the *Iron Age*, very justly says:

"The absence of such an institution has long been felt, and with the example of the great success of kindred societies, both in this country and abroad, before them, it is a matter of some surprise that such a movement has not taken definite shape at an earlier period. Until now a few papers, which naturally would belong to the domain of such a society as that proposed, have been presented under unfavorable auspices to such societies as the American Institute of Mining Engineers, or the American Society of Civil Engineers, where naturally they did not elicit the discussion and consideration which they merited, nor did they go directly into the hands of those whom they were chiefly designed to reach. We have every reason to believe that the new society will meet with ample encouragement and strong support, and it remains with those organizing it to make it as successful as its older sister associations. As much depends upon its first organization, we trust that English models, if followed, will be sufficiently modified to be adapted to the peculiarities of this country. The names of those identified with it, however, are a guarantee that wise and liberal counsels will prevail."

Correspondence and conversations with many able engineers in this city and various parts of the country, since our last issue, together with a number of inquiries about eligibility and membership, lead us to believe that the practical men of the country will not only take kindly to the new organization, but will give it an enthusiastic support.

As yet no active steps have been taken by the chairman, Mr. A. L. Holley, toward appointing committees for the April meeting, but an active movement in the direction of complete and vigorous organization will soon be made. A society which, as first stated by Professor Thurston, and afterward by one of the speakers present at the meeting, has power to "benefit our industries to the extent of millions of dollars annually," cannot fail to benefit the industrious workman, whose interests lie close to the heart of every right-thinking mechanical engineer.

An Inventors' Institute.

The venerable philanthrophist, Peter Cooper, is building another story to Cooper Institute, in this city, which is calculated to accommodate an additional number of students in the various departments of science and art, in which instructions are given, as well as to provide room for a kind of new museum and patent agency, called the Inventors' Institute. This last organization has had existence a few months, at 733 Broadway, its object being, as stated, "to aid and assist inventors in various ways." It was started as a business venture, and, having attracted the attention and sympathy of Mr. Cooper, he became its patron and financial supporter, making the addition to Cooper Institute, mainly, it is stated, to afford it ample facilities for working. A museum of models and curiosities is to be maintained for inventors to study upon, and in which to place their own original designs. Steam power is to be provided for the purpose of making models, and to exhibit models and machinery in motion. We are informed by its promoters that "a leading feature of the Inventors' Institute is the facilities it offers for bringing inventors in direct communication with capitalists and manufacturers to whom their inventions will be of use, thus affording the inventor a chance of selling his patent or putting it to practical use." But the feature which will most provoke the hostility of patent solicitors is a department for procuring patents in which the charges are to be made very moderate. The entrance fee for the first model will be $10, and $5 each for those that follow. A fund is to be set aside to provide the means for those who have inventions of merit and are too poor to pay the first costs of the patent office and incidental expenses.

We know nothing of the individuals Mr. Cooper has entrusted with the management of this institution, but if they are the *right men*, a great deal of good may be accomplished.

LITERARY NOTES.

A PRACTICAL TREATISE ON HIGH PRESSURE STEAM BOILERS, including results of recent experimental tests of boiler materials, together with a description of approved safety apparatus, steam pumps, injectors, and economizers, in actual use. By Wm. M. Barr, author of A Practical Treatise on the Combustion of Coal, Engineering Sheets, Etc., 456 pp., 204 illustrations. Price, $4. Published by Yohn Brothers, Indianapolis, Ind.

This book, instead of being written in a technical manner, as most books bearing upon the subject under consideration have been, has been compiled by the author from the results of numerous tests, and an extensive practical experience. Mr. Barr goes to the root of the whole subject by first considering the chemical composition of the iron from which boilers are to be made, also how to determine the best material for such purposes, describing the impurities which are commonly found in the same.

The arguments for and against the use of cast iron as a material for steam boilers are well taken, and throw much light on the subject.

The author then takes up the subject of wrought iron, and enters into an analysis of boiler plate, also pig iron, to show the change in the proportions of substances contained in the iron, during the process of manufacturing. Tables from tests made, show the properties and strength of different specimens of iron.

A discussion on the use of steel for the manufacture of steam boilers is then entered into, in which the faults of the earlier steel plates are explained, also the importance to manufacturers of studying, in order to fully understand the nature of the material. Numerous examples are given, showing the characteristics of iron and steel containing different proportions of carbon, besides analysis of steel made by different manufacturers.

The chapters on the strength of wrought iron and steel have been carefully compiled from tests made, with samples sheared from plates actually delivered for boilers under contract, and were not selected samples taken from the mill, with a view to getting high results.

Steel is undoubtedly destined to be the material of which the boiler of the future is to be made. This subject is treated extensively, and numerous tests have been made, the results of which now appear in print for the first time. The chapter on riveted joints is very valuable and interesting.

Numerous tables are presented, which show the safe working pressures of boiler-shells, also flues and tubes. The computation and proportions of heating surface, circulation of water, horse-power, and properties of steam have been ably discussed.

The chapters on firing boilers presents some very interesting data of the boilers used in different parts of the world.

Most of the data here given has been obtained from actual test, and is, therefore, reliable. The chapter relating to the setting of boilers will be highly interesting to the class of workmen engaged in that branch of mechanics, as it contains full descriptions of the best furnaces known to practical science. Boiler appliances are treated exhaustively.

LYMAN'S UNIVERSAL SCREW-CUTTING INDEX.—One sheet on fine paper. Price, ten cents.

This sheet contains rules for figuring compound gearing for cutting screws upon lathes, also contains tables for use, all worked out. The rules are simple and plain. Its true value can only be appreciated by the practical man.

LYMAN'S GEAR CHART.—One sheet on fine paper, with eight illustrations. Price, fifty cents.

The object of this chart is to show how to lay out the form of the teeth of gear wheels, on the odontograph principle of Prof. Willis, both single and double curves, also a diagram of a practical odontograph and an odontograph scale, with full-sized illustrations of the method of laying out single and double curved teeth in wheels and racks. This sheet contains a gear scale for proportioning the teeth of wheels in accordance with the best American practice, also a rule for reducing diametrical pitch to circumferential, with tables applying to the same. The examples are plain and comprehensive and the suggestions practical.

THE AMERICAN STANDARD OF BOLTS AND NUTS.—Full-sized drawings on one sheet of fine paper. Price, $1.00. Published by Edward Lyman, C.E., New Haven, Conn.

This sheet contains full-sized drawings of the Franklin Institute system of bolts and nuts, as recommended by them, Dec. 15, 1864, and adopted by the United States Navy, in May, 1868. It has also been extensively adopted among the leading tool builders and machine shops in the country. This system is adopted by every one who desires to produce uniform or standard work. These drawings show all sizes of bolts in the system, from ¼ inch in diameter up to three inches in diameter, with the heads and nuts all drawn full size.

The following dimensions are all shown on each bolt, and in their proper place, viz: The diameter of the bolt; the number of threads to the inch; the width, or short diameter of the head, and nut.

The long diameter, or length across the corners of the head, and nut; the length of one side of the hexagon head, and nut; the thickness of the head; the thickness of the nut; the diameter of the hole in the nut, when bored for tapping, also an enlarged section of the form of thread reccommended with the given angle. All these drawings are intended to be glued to a board, and varnished for service in the shop. When thus prepared they will last for years.

Business Specials.

Forty cents a line for each insertion under this head.

Manual of Power for Machines, Shafts, and Belts, with the History of Cotton Manufacture in the United States, by Samuel Webber, C. E., copyrighted 1879. Only work of the kind extant; 240 pages. Price $3. Address, D. Appleton & Co., New York, or the author, Manchester, N. H.

To Manufacturers.—We are prepared to furnish Recipes and Information on all Industrial Processes. Address Park Benjamin's Scientific Expert Office, 37 Park Row, New York.

John Fish, M. E., Room 23, 8 & 10 Pine Street, New York. Special attention given to Designing and Superintending the Construction of Improved Machinery. Hoisting Engines, Air Compressors, and Pneumatic Motors a Specialty. Working Drawings and Plans, Specifications and Estimates furnished.

See Christiana Machine Co's advertisement, next number.

Thorough instruction in mechanical drawing, practical drafting and studies relative thereto, given at schools or by private lessons. T. P. Pemberton, 249 Duffield Street, Brooklyn, N. Y.

Lathe Attachments for Milling Plane and Irregular Forms; Taps and Reamers fluted and Gears cut without removing from the lathe centers. For extended description, see AMERICAN MACHINIST, Sept. 13 and 20 issues. Send for circular to Wm. Main, Piermont, N. Y.

A new No. 7 Earl Steam Pump for sale cheap. Address Pulsometer Steam Pump Co., No. 40 John Street, New York.

Questions and Answers.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly and according to common sense methods.

(1) J. S. Merrimac, San Louis Co., writes: Will you please inform me as to the horse power of a boiler? The measuments are as follows: Length of boiler, 18 feet; diam., 48 inches; number of flues, 10 diameter, 6 inches; number of feet grate surface, 23 feet. *A.*—Divide the heating surface by 12, the result is the horse power of boiler. Thus—

The heating surface of lower ⅓ of shell of 18″×48″—	113 ft.
The heating surface of lower ⅓ of ends minus flues—	21 "
The heating surface of lower ½ of flues—	113 "
	249 sq.feet.

247÷12=20.58 horse power.

You have too much grate surface for heating surface; ⅘ of a square foot per horse power is ample.

(2) W. H. M., Titusville, Penn., asks: Which is the most economical way to heat water for a bath house having three tubs? It is heated at present by a spiral coil of ¾-inch pipe in a round sheet-iron stove; there is about fifty feet of pipe in the coil, and it gets choked with the lime or magnesia in the water, very often necessitating costly repairs. The coil is connected with a Scaife boiler, in the usual way. *A.*—We would advise using an upright boiler having a circulating diaphragm in the inside, to prevent the lime from depositing on the fire-box crown sheet, and, by means of a properly-arranged mud-drum you can draw the deposit away from the fire-box sheets. The coil could be placed in a casing on top of the boiler, thus getting the benefit of dry superheated steam.

(3) I. C. D., Indianapolis, Ind., writes: Can you tell me how holes can be enlarged in rock, so as to hold foundation bolts? I want to enlarge the lower portion of the hole, so as to lead or wedge them in firmly. *A.*—Split the end of the bolts that goes down into the rock, and into this split end insert a wedge, the thick end of the wedge to project far enough beyond the end of the bolt so that when the bolt is inserted in the hole, and driven down upon the wedge, it will be held tight enough in the rock to resist any strain that may be brought upon it by the nut.

(4) J. J. S., Rutland, Vt., asks: How can I anneal steel soft enough to cut letters upon it? *A.*—Put the pieces into an iron box, and cover on all sides with saw dust mixed with pulverized charcoal. Place the lid upon the box, and put it in a furnace (for small articles a stove will do) and let them remain about three hours, according to the size of articles; then allow them to cool slowly. The longer time allowed in the furnace the softer will be the steel. 2. What kind of tools are generally used for cutting the same? *A.*—Engraving tools are used which are suited to the different classes of work required. Some engravers use a triangular-pointed tool for most all kinds of work, while others use about two dozen. We would say from six to eight engraving tools would be sufficient for general work. These can be procured from any dealer in small tools.

(5) P. W. L., Grinnell, Iowa, asks: Will you please tell me the cost of a galvanic battery capable of galvanizing a ton of wire in a day, also the probable cost of running it? The wire is ordinary fence wire. Is there any particular way of galvanizing such wire? *A.*—We are not aware of any process in practice by which wire may be galvanized by the use of a battery, and therefore cannot give you the cost. The most rapid process of galvanizing wire, as practiced by the leading manufacturers, consists in passing the wire through an acid solution; then through a bath of melted zinc, and finally it is wound upon a reel. The cost of fitting up for this work cannot be given definitely, unless we have further particulars.

(6) J. L. H., Bowling Green, Ky., writes: I am twenty years of age, and have studied philosophy, also possess a mechanical turn of mind, and have a very fair education. I desire to become a locomotive engineer, have had some experience with stationary engines. 1. Will you inform me what is necessary in order to secure a situation? *A.*—Search for a man who could use his influence in placing you upon a locomotive as fireman, and when you have found such a person cultivate his acquaintance. You need not restrict yourself to one man only, but select a number. 2. Do you know of any roads that employ inexperienced hands? *A.*—All roads in this country practice this to a more or less extent. 3. Would I be required to brake before I could fire? *A.*—Not necessarily, although some roads adopt this rule; but this custom is not now practiced as much as it was, as it does not directly help a man to be an engineer. 4. Is there any treatise on running locomotive engines? *A.*—We would advise you to read Forney's Catechism of the Locomotive, also Locomotive Engine Driving, by Reynolds.

MANUFACTURES

The Hendey Machine Co., Wolcottville, Conn., are about to build an addition to their works 30x40 ft., two stories high. They are very busy—full of orders—but complain of the scarcity of machinists.

The Cuyahoga Works, of Cleveland, Ohio, have built recently, or have now under way, eight large vertical blowing engines, for blast furnaces, from their new patterns, the steam cylinders being 36″ bore, by 48″ stroke, and the air cylinder 84″ bore, by 48″ stroke. These engines contain several new and valuable features, which are much liked by furnaces having them in use. We hope to illustrate these features at an early day in our columns.

Frank H. Pond, M. E., 214 N. 8th Street, St. Louis, has been appointed Western agent for Henry R. Worthington, manufacturer of pumps and hydraulic machinery.

The Broad Brook Co., woolen manufacturers, of Broad Brook, Conn., have just put in two of Beach & Sons, 5½ feet drop flue boilers, and are running full, their engines having been thoroughly repaired.

Under date of February 15, the *Cincinnati Enquirer* publishes the following concerning iron trade matters in St. Louis, which will afford important data to both consumers and producers throughout the country:

The Vulcan Iron Works, in this city, will resume operations in about four weeks, employing twelve hundred men, and producing three hundred tons of finished rails daily.

Following is a summary of the number of men employed in other works now running, with the daily production of iron:

Missouri Furnace Company, two hundred men; three hundred and fifty tons pig-iron.

Laclede Rolling Mills, four hundred and fifty men; one hundred tons finished iron, chiefly light rails.

Helmbacher Forge and Rolling Mills, two hundred men; twenty-five tons bar iron and rails, and twenty tons car axles and shafts.

McDonald & Bro.'s Steam Forge and Rolling Mill, ninety men; twenty tons of finished iron.

Missouri Car and Foundry Company, one hundred and eighty men; two hundred car-wheels and thirty tons of castings.

St. Louis Car Wheel Works, one hundred and fifty men; one hundred and seventy-five car-wheels and fourteen tons gray iron.

St. Louis Iron and Machine Works, ten tons finished iron and machine work.

Tudor Iron Works, fifty men; twenty tons of railroad spikes.

St. Louis Bolt and Iron Company, sixty-five tons of light rails, bolts and spikes.

Pullis & Sons, seventy-five men; thirty tons of wrought iron.

Shieble, Harrison & Co., two hundred and fifty men, fifty-five tons cast-iron and fifteen tons wrought-iron.

St. Louis Malleable Iron Works, one hundred and twenty-five men; thirty tons of castings.

Christopher Simpson & Co., seventy-five men; fifteen tons cast-iron and five tons wrought.

Kilpatrick & Gray, forty men and five tons cast-iron.

Harrison Wire Works, five hundred men and forty tons of wire.

There are a few smaller works not included in the list. Many of the works are now running night and day, and most of them report orders for three months ahead.

Skinner & Wood, of Erie, Pa., made 140 portable engines in 1879.

Machinists' and Engineers' Supplies.

NEW YORK, Feb. 26, 1880.

The supply market continues unchanged, with little or no indication of prices changing at present.

J. M. Montgomery, 105 Fulton St., N. Y., has just received an invoice of an improved foot lathe, made by B. Prentice, of Worcester, Mass. These machines are claimed to be superior to any heretofore produced by the manufacturer. The prices have been advanced about 25 per cent., and the manufacturer is unable to supply the demand.

The manufacturers of the Root Blowers, S. S. Townsend, Agent, 6 Cortlandt St., N. Y., have just issued a new catalogue of 26 pages, which describes their improvements, also gives statistics.

James D. Foot, 40 Broadway, New York, is the manufacturers' agent for a number of small tools for machinists' use, which are both valuable and cheap. Among them are his Pin Vise, Perfection Chuck, Tap Wrench, retail price, one dollar; Machinist's Scratch Awl, price, 25 cents; Marking Gauge and Scratch Awl combined, price, 75 cents; Surface Gauge, price, $2.

The Brainard Milling Machine Co., Hyde Park, Mass., have issued a new 33-page illustrated catalogue of machine tools, containing several new machines.

Iron Review.

NEW YORK, Feb. 26, 1880.

The market seems somewhat more quiet since last report; prices are unchanged. The mills still seem to have all they want to do, and are not able to accept orders for immediate delivery, except in a few instances. The market is steady, and promises to remain about as it is for some time to come.

Pierson & Co., 24 Broadway, N. Y., under date of Feb. 26th, 1880, quote prices out of store as follows:

No. 1, X Pig, $42½ per ton; Iron Rails, $68 to $70, according to weight; Old Rails $44 to $45; Fish Plates, 4c. per lb.; Railway Spikes, 4¾c.; Bolts and Nuts, 5½c.; Common Bar Iron, 3 7-10c., basis from store; Refined, 4c., basis; Ulster, 5c., basis; Machinery Steel, 7c.; Best Tool Steel, 13½c.; Norway Bar Iron, 6¼c.; Norway Shapes, 6¾c.; Nail Rods, 7c.; Sheet Iron, 5c., basis; Angle Iron, 4 3-10c.; Tee Iron, 4 8-10c; Band Iron, 4 7-10c.; Hoop Iron, 4 8-10c. and up according to size; Horse Shoe Iron, 4 7-10c.; Hot Polished Shafting in lengths, 2 ft. and longer, 9 to 10½c., according to size; Small Black Rivets 30% off in papers, 10% off in bulk.

Boiler-makers supplies: Flange, 6¾c.; C. H. No. 1 Shell, 5¾c., C. No. 1, 4¾c.; Sheets, 4¼c. basis; Boiler Tubes, 5 and 5% discount.

Metal Review.

LUCIUS HART & CO., 8 & 10 Burling slip, New York, furnish us the following, under date of Feb. 26, 1880:

The Metal Market remains dull. Pig Tin in London, £95; Singapore, $30⅞. We quote spot, market nominally. Banca Tin, 26c.; Malacca & Straits, 23½c.; Australian & Billiton, 23@23¼c.; "Lamb & Flag," 23c. Pig Lead, dull but strong, 6½c. Antimony, 20@24c.; as to brand. Spelter, strong, 6¾c. for either Foreign or Domestic. Ingot Copper, 24½c. Nickel, $1.25. No. 1 Solder, 13c.; "Half & half," 15c.

Situations Wanted—Help Wanted.

We will publish notices suitable for the above headings, applying to any of the machinery trades, and not to exceed four lines each (32 words), at the nominal rate of twenty-five cents for each insertion.

WANTED—A situation in a machinists shop by a well-educated man, with short experience of tools and jobbing work. Address Mr. Bostock, care Mr. E. Moss, 26th Street and Penn Avenue, Pittsburgh.

Situation Wanted—By a Practical Steam Fitter of twenty years' experience—a situation as foreman. Thoroughly understands steam heating, high or low pressure, direct and indirect radiation. Would prefer the West. Can furnish first-class testimonials. Can make plans, specifications and estimates of steam heating. Address STEAM, care of Geo. Sargent, South Weymouth, Mass.

WANTED.—50 good machinists and a few boiler makers. Good wages and plenty of work. Address or call at once on W. F. Parish, Supt. Stearns Mfg. Co., Erie, Pa.

TO ENGINE BUILDERS, &c. A strictly first-class man, well up in all modern steam economy, will be open, by the 1st of March, for an engagement, as Superintendent or manager. Middle or Southern states preferred. Address, J. W., care AMERICAN MACHINIST, 96 Fulton St., N. Y.

A competent man, who has been machinist, engineer, and master mechanic, wants a position as master mechanic or superintendent of machinery. Best references. Address, A. V., care AMERICAN MACHINIST, 96 Fulton St., New York.

Drawing Instruments
AND MATERIAL, PAPER, &C.
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116 Fulton Street, New York.
Fully priced and illustrated Catalogues.

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DRAWING COPIES
TEN CENTS EACH.
Send for List of Plates, now ready, and Catalogue of Books for Practical Engineers.
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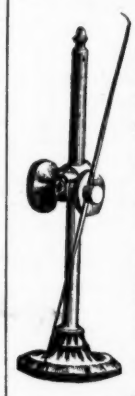
DeadStroke Power Hammers
Are superior to all others for Forging and Die Work. Over 500 now in use. Manufactured by
PHILIP S. JUSTICE,
14 N. 5th St., Philadelphia, Pa.

JAMES D. FOOT,
No. 40 Broadway, New York.
MACHINISTS' SURFACE GAUGE.



Height, 8 inches. Arm will scratch 8 inches and 13 inches high. Nickel Plated and a first-class tool. Price, $2.

The Perfection Chuck is thoroughly well-made and is a perfectly true running Chuck. Jaws and Shank of best imported tool steel. It will center and hold drills from the smallest to 3-16 inch. Shell Polished and Nickel Plated. Mechanics, Manufacturing Jewelers and Silversmiths will find this tool suited to their wants for all light work. Retail price, $1.00.

This Pin Vise is for holding all small sizes of Wire to 3-16 of an inch, also for Filing Pins, Pointing Screws, &c. It has four tempered steel jaws, a hollow wood handle, is full Nickel Plated, and the most complete tool of its class in market. Retail price, $1.00.

All tools warranted. Send stamp for catalogue.

Prices stated include postage.

PERFECTION CHUCK.

PIN VISE.

BUCHANAN'S UNIVERSAL CRUSHER.

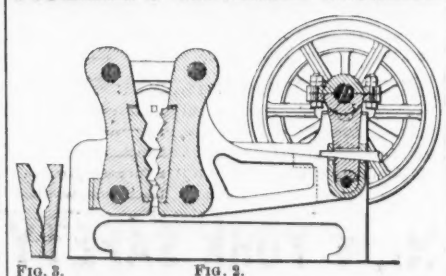


FIG. 3. FIG. 2.

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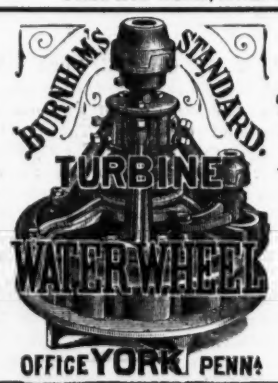

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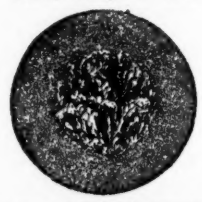

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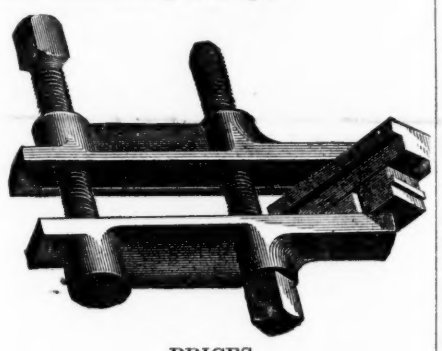

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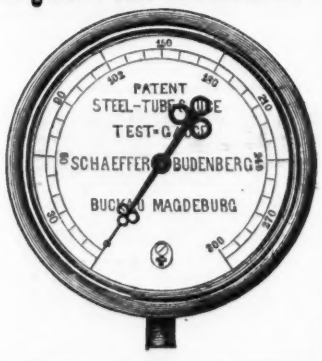

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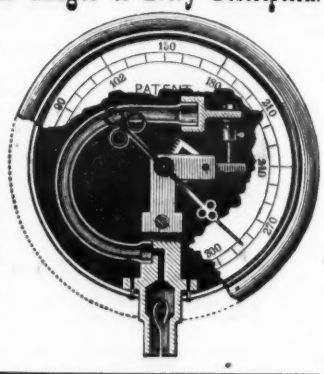

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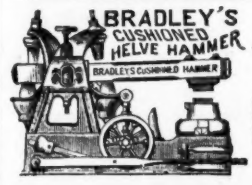

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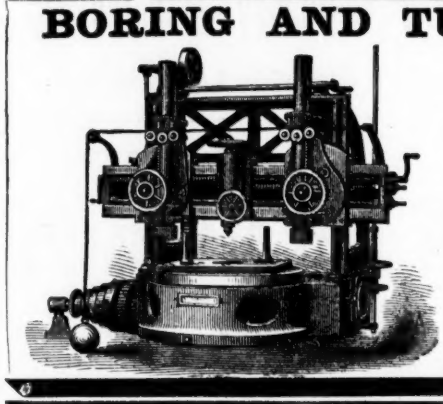

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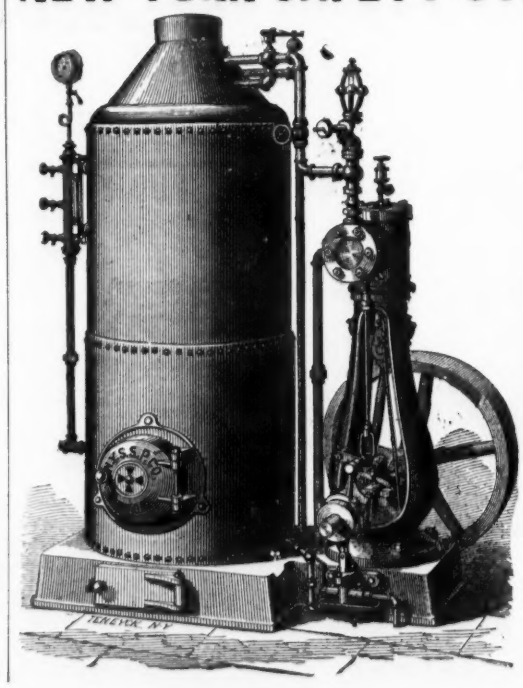

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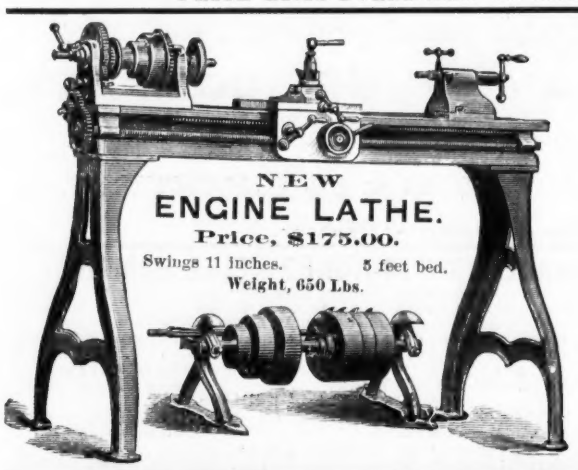

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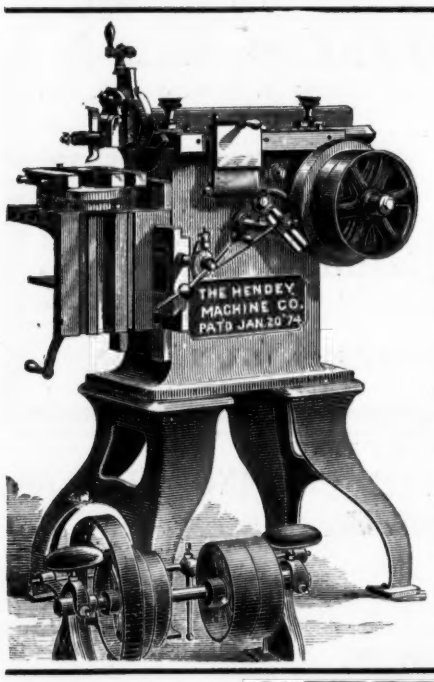

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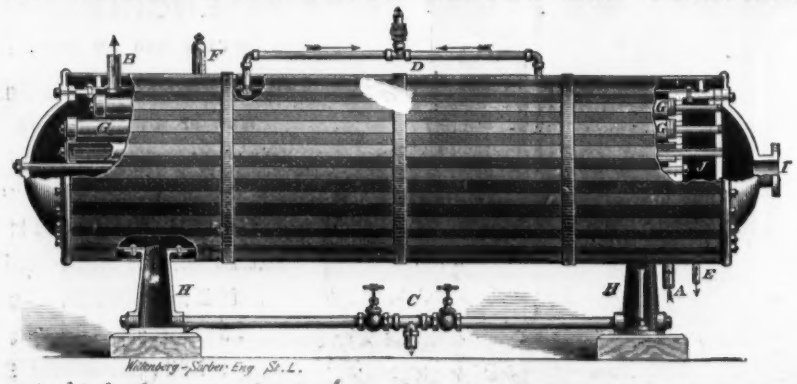

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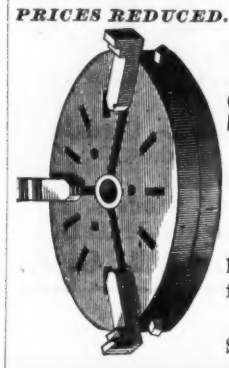

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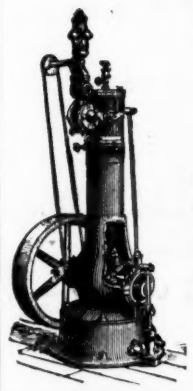

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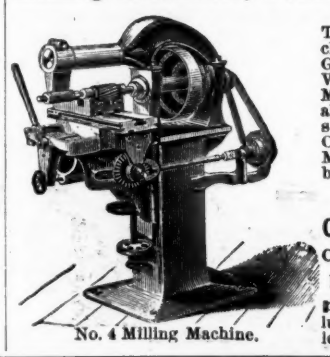

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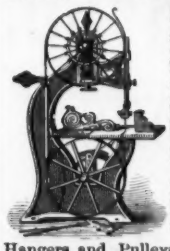

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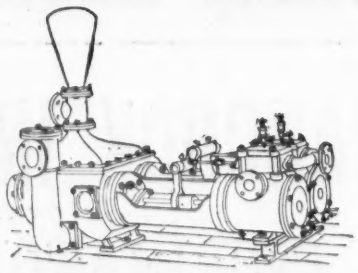

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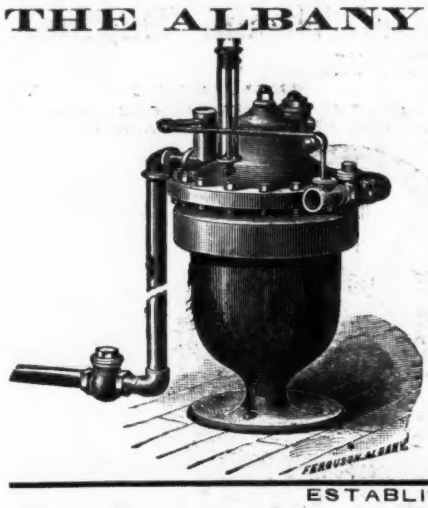

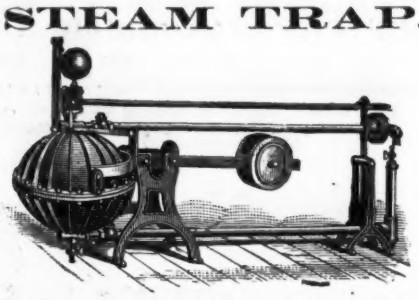

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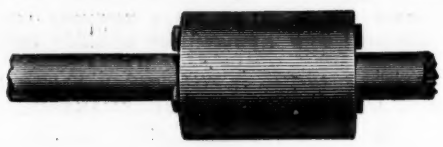

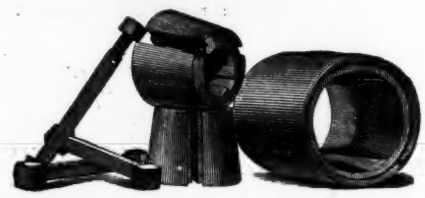

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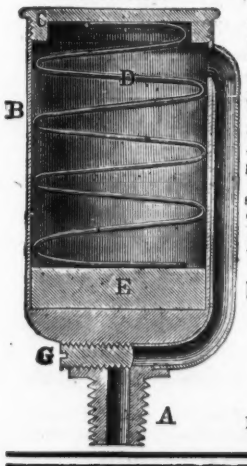

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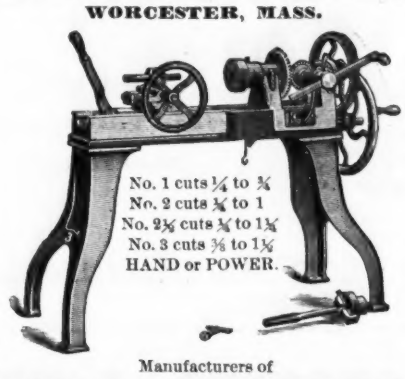

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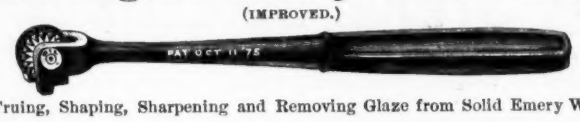

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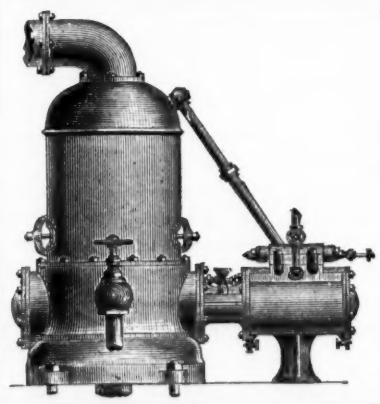

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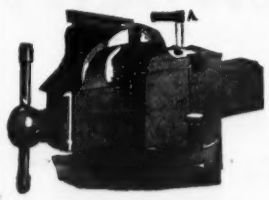

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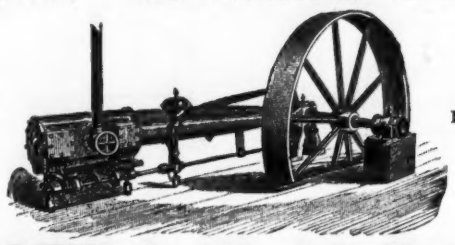

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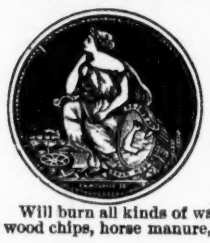

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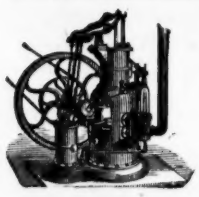

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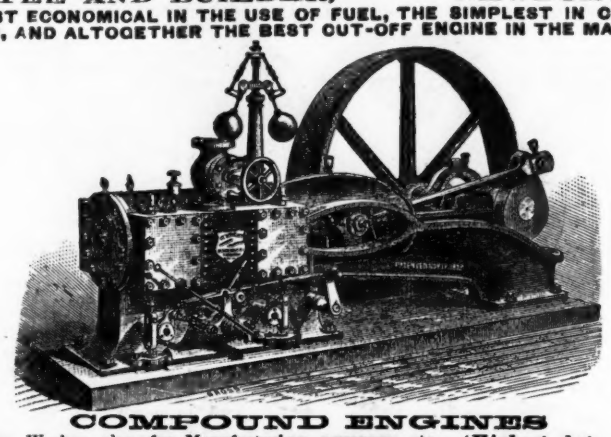

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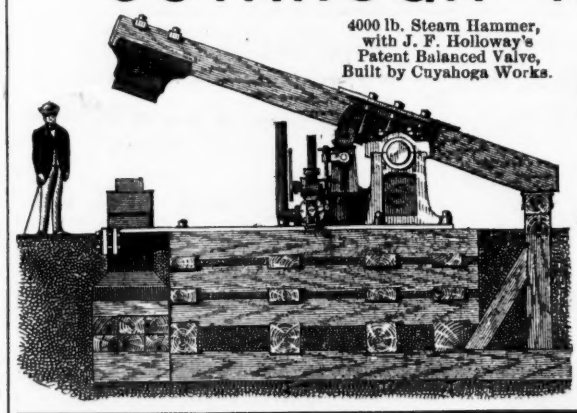

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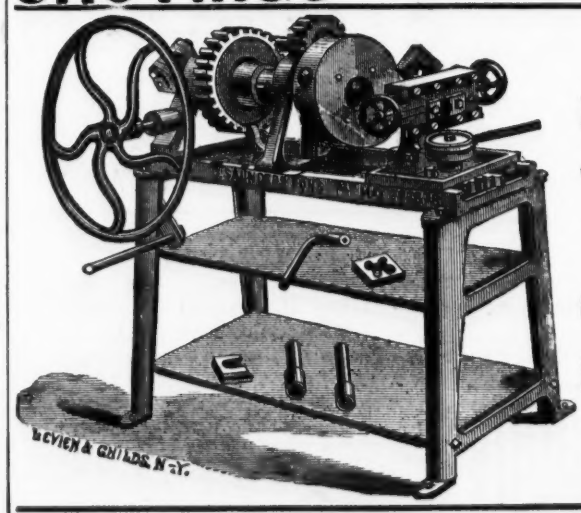

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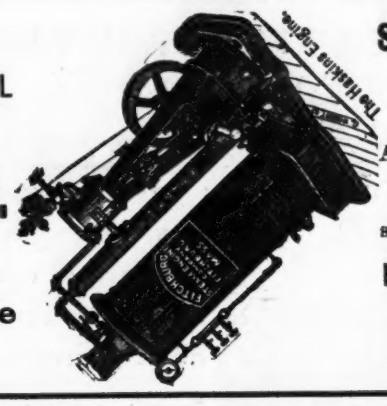

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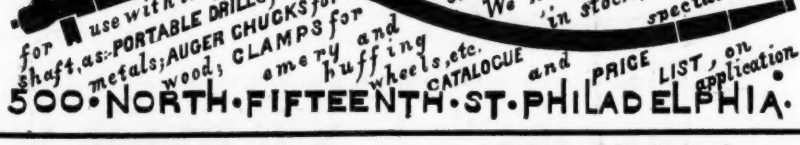
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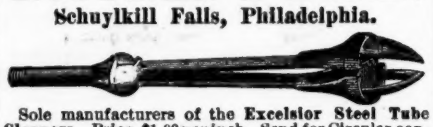

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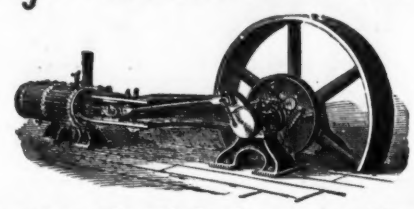

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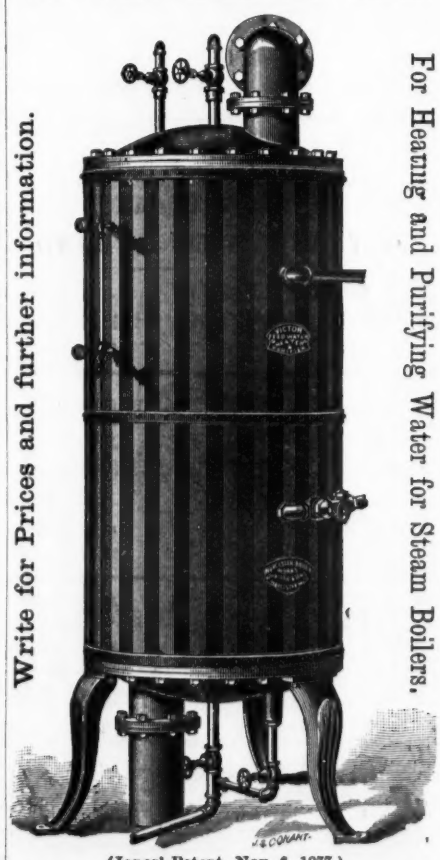

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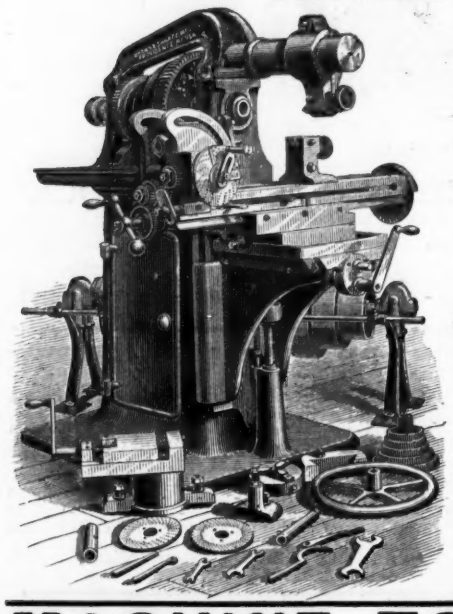

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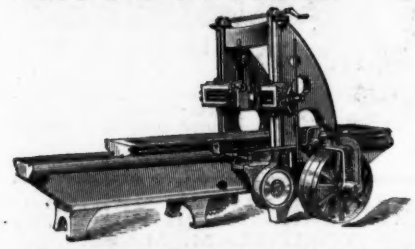

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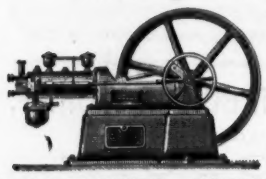

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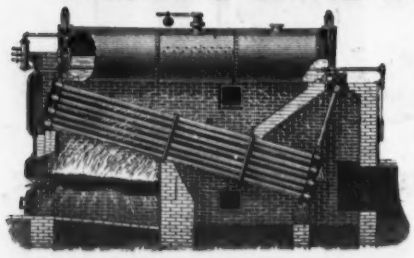

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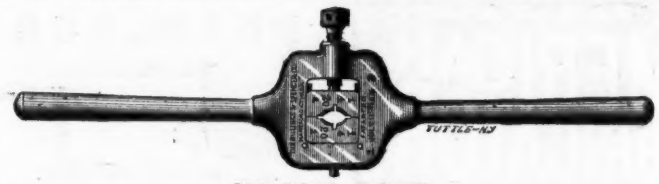

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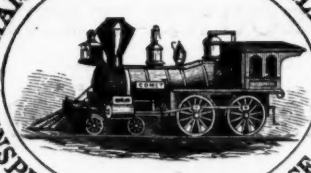

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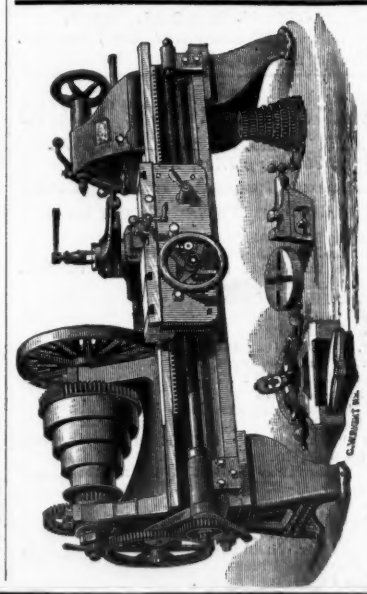

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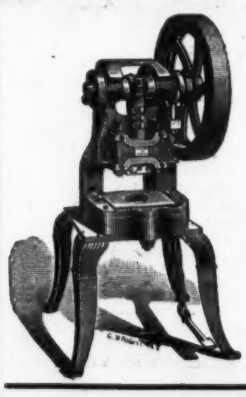

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